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FEDERAL AID IN FISH RESTORATION
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ARCTIC AREA TROUT STUDIES

T-7-1 Terrence N. Bendock and John M. Burr

ALASKA DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner
Division of Sport Fish
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STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

ARCTIC AREA TROUT STUDIES

by

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ALASKA DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner

DIVISION OF SPORT FISH
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RESEARCH PROJECT SEGMENT

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Cooperators: Terrence N. Bendock and John Burr

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ABSTRACT

This report presents baseline fisheries information on the diversity, distribution, and growth of freshwater and anadromous fish inhabitating lakes and stream channels within the Colville River delta. Sampling was conducted with graduated-mesh gill nets and seines in the Colville River between the confluence of the Kikiakrorak River and Harrison Bay. Lake surveys were conducted on 16 lakes within the Colville River delta.

Eighteen species of fish representing nine families were captured within the study area. Species in the family Salmonidae accounted for 90% of the total harvest, and the five species of whitefish found in the Colville River delta accounted for 77% of the harvest. Anadromous species accounted for 69% of the harvest, while freshwater and marine species accounted for 29% and 2% of the harvest, respectively. A single species, least cisco, *Coregonus sardinella* (Valenciennes), accounted for 38% of the entire harvest. They represented 57% of the harvest in lakes, 25% of the gill net harvest in the river, and 44% of the seine harvest in the river.

The Colville River delta appears to provide important habitats for juvenile fish during the open-water season; however, the majority of larger fish (both adult and subadult) taken by gill net appears to be transient, nonfeeding migrants. Both lake and stream habitats within the delta are used for spawning by several species of freshwater and anadromous fish.

Length, weight, age, and maturity data are presented for the principal species of fish encountered in this study.

A survey of Amiloyak Lake was conducted during 31 July to 2 August 1985. Sampling for fish was conducted by gill net, hoop net, minnow trap, and baited set line. Information is provided on length, weight, age, and maturity of five species of fish captured in Amiloyak Lake.

Approximately 27,000 fertilized eggs were obtained from Arctic char, *Salvelinus alpinus* (Linnaeus), captured at Amiloyak Lake. The eggs were transported to the Clear Hatchery for incubation and rearing. The fingerlings resulting from this egg take will be evaluated experimentally for use in the interior Alaska lake-stocking program.

Aerial char surveys in both the Ivishak and Anaktuvuk Rivers were not conducted during 1985 because of adverse weather conditions.

KEY WORDS

Colville River, North Slope, whitefish, Colville delta, Amiloyak Lake, Arctic char, egg take, lake and stream surveys, aerial surveys.

BACKGROUND

The Colville River is the largest Arctic river in Alaska, draining approximately 24,000 sq mi. It is the seventh largest drainage in the state and supports the most diverse freshwater and anadromous fish fauna of any North Slope lake or stream. At least 18 species of freshwater and anadromous fish are known to inhabit the drainage, supporting subsistence, commercial, and recreational fisheries. Table 1 lists the scientific and common names of fish encountered during the present study.

Petroleum industry activities have recently expanded westward from Prudhoe Bay, with developments at Milne Point, the Kuparuk oil field, and the Colville River delta. Industrial activities, such as causeway and gravel island construction, gravel mining, water withdrawal, and road construction, have the potential for altering the feeding and migration behavior of freshwater and anadromous fish as well as diminishing the quality of habitats critical to their survival.

The present study was designed to provide information on freshwater and anadromous fish diversity, distribution, life history, and habitat utilization within the Colville River delta. The study area (Fig. 1) includes the principal east-side tributaries to the delta between Ocean Pt. and the Beaufort Sea as well as several lakes within the flood plain of the delta.

Past fishery research in the Colville River delta is limited to a few investigations conducted since 1970. Roguski and Winslow (1970) reported on species composition, relative abundance, age, growth, and sexual maturity of broad whitefish, humpback whitefish, Arctic char, and several other species captured in the Colville Delta commercial fishery. Kogl (1971) presented additional information on the distribution and life histories of several species inhabiting the lower Colville River.

Table 1. Fish species found in lakes and streams of the Colville River delta, 1985.

Common Name	Scientific Name and Author	Abbreviation
Alaska blackfish	*Dallia pectoralis* Bean	AB
Arctic char	*Salvelinus alpinus* (Linnaeus)	AC
Arctic cisco	*Coregonus autumnalis* (Pallas)	ACI
Arctic flounder	*Liopsetta glacialis* (Pallas)	AFL
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Arctic lamprey	*Lampetra japonica* (Martens)	AL
Broad whitefish	*Coregonus nasus* (Pallas)	BWF
Burbot	*Lota lota* (Linnaeus)	BB
Fourhorn sculpin	*Myoxocephalus quadricornis* (Linnaeus)	FSC
Humpback whitefish	*Coregonus pidschian* (Gmelin)	HWF
Lake trout	*Salvelinus namaycush* (Walbaum)	LT
Least cisco	*Coregonus sardinella* (Valenciennes)	LCI
Longnose sucker	*Catostomus catostomus* Forster	LNS
Ninespine stickleback	*Pungitius pungitius* (Linnaeus)	NSB
Pink salmon	*Oncorhynchus gorbuscha* (Walbaum)	PS
Rainbow smelt	*Osmerus mordax* (Mitchill)	RSM
Round whitefish	*Prosopium cylindraceum* (Pallas)	RWF
Slimy sculpin	*Cottus cognatus* Richardson	SSC

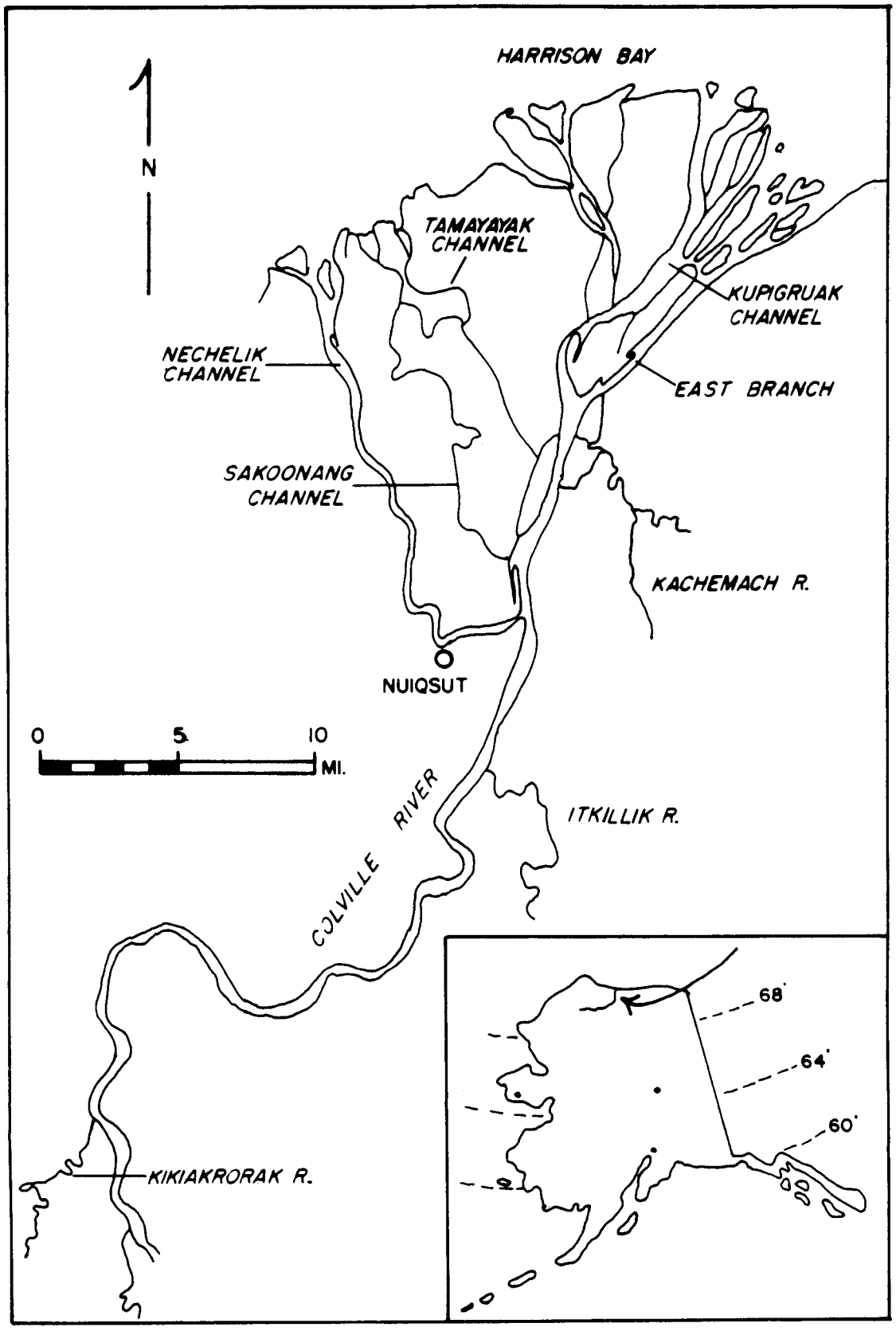

Figure 1. Map of the Colville River delta, Alaska study area.

Meristic counts for Colville River whitefish were reported on by Alt and Kogl (1973). Kogl and Schell (1975) reported on life-history data for several species from the Colville delta and on a brief reconnaissance of overwintering conditions that was conducted with the aid of an underwater television camera. McElderry and Craig (1980) surveyed sections of the lower Colville River and several lakes within the delta in an effort to locate Arctic cisco spawning habitats. Craig and Haldorson (1980) gill netted under the ice at two locations in the Colville delta during April and May 1978. The petroleum industry is currently funding an investigation of fish-movement patterns and life history in the delta as well as an investigation of overwintering habitats in the delta; however, results of these studies are not yet available.

In addition to investigations in the Colville River delta, this report presents information on an experimental Arctic char egg take conducted at Amiloyak Lake and fall aerial surveys of Arctic char conducted in the Ivishak and Anaktuvuk Rivers since 1971.

RECOMMENDATIONS

Management

1. Continue to monitor permit applications and industrial activity occurring within North Slope waters, with emphasis on potential impacts to aquatic resources.

2. Continue to monitor recreational fisheries occurring on the North Slope.

Research

1. Lake and stream surveys should continue, on a priority basis, with emphasis on areas of present and future industrial development.

2. Continue aerial surveys of Arctic char in the Sagavanirktok and Anaktuvuk River drainages.

3. Continue the experimental Arctic char egg take at Amiloyak Lake, with the objective of delivering 75,000 viable eggs to the Clear Hatchery for incubation, rearing, and experimental stocking in Interior waters.

4. Initiate a study to investigate lake trout life history and population dynamics in North Slope waters.

OBJECTIVES

1. To determine the diversity and distribution of freshwater fish inhabiting lakes and stream channels within the Colville River delta.

2. To categorize the age, weight, length and sexual maturity of fish captured within the study area.

3. To characterize the habitats within the Colville delta used for spawning, rearing and migration by the principal species of freshwater and anadromous fish.

4. To describe selected physical and chemical characteristics of sample sites within the Colville River delta.

5. To obtain 50,000 fertilized Arctic char eggs from Amiloyak Lake for hatchery incubation, rearing and stocking experiments in interior Alaska waters.

6. To index fall abundance of anadromous Arctic char in the Ivishak and Anaktuvuk Rivers.

TECHNIQUES USED

Lake And Stream Surveys

An aluminum riverboat powered by two 85-hp outboard motors and equipped with jet units was used to transport personnel and equipment during surveys of the lower Colville River. Fuel and additional supplies were cached within the study area, using a float-equipped Cessna-185 aircraft. Transportation to lakes within the delta and to Amiloyak Lake was provided using float-equipped aircraft.

Physiographic data, as well as longitude and latitude, were determined from topographic maps and sectional aeronautical charts (1:63,360 series)of the U.S. Geological Survey (1955).

Water-chemistry data were obtained using a Hach AL-36B field-test kit and Yellow Springs Instrument STC meter. Water depths were recorded with a Lowrance fathometer. A standard 10-inch black and white Secchi disc was used to determine water clarity.

Monofilament sinking and multifilament floating graduated-mesh gill nets measuring 125 x 6 ft and consisting of five 25-ft panels of 0.5-inch through 2.5-inch bar mesh were used to capture fish. A minimum of one floating gill net attached to shore and one sinking gill net was set in each of the Colville delta lakes.

Hoop nets measuring 12 ft in length by 3 ft in diameter were constructed with seven fiber-glass hoops; cylindrical throats were located on the second and fourth hoops; and it was covered with 1-inch mesh net. These nets were used to capture fish during the August sampling period in the Colville River delta. Hoop nets were baited with whitefish and set on the river bottom. Hooks baited with whitefish and grayling were set overnight to capture burbot.

A 100-ft by 4-ft beach seine with 0.5-inch mesh was used to sample fish in shallow-water habitats within the Colville River delta. A single 100-ft haul, terminating on the beach, was made at each sample site.

Biological Sampling

Fish sampling was conducted in the field. All samples were grouped by date, location, and gear type. Fork lengths were measured to the nearest millimeter. Weights were measured to the nearest 25 grams using a Chatillon spring scale. Sex and stage of maturity were determined by examining gonads. A sample of scales was removed from all whitefish, grayling, and salmon, while otoliths were obtained from char, lake trout, and burbot. The taxa of principal food items and estimate of stomach fullness were recorded for each fish sampled.

Eggs for fecundity samples were preserved in 10% buffered formalin. Fecundity was determined by displacing a volume of water with a known quantity of eggs. The total number of eggs was then calculated using the quantity of water displaced by the entire ova mass.

A binocular microscope was used to determine ages of char, lake trout, and burbot from otoliths wetted in alcohol or water. All other fish were aged by reading scales. Scales were cleaned and impressed on 20-mil acetate sheets. A Bruning-200 microprojector was used to read the scales.

Arctic Char Egg-take

Prespawning Arctic char in Amiloyak Lake were captured in monofilament graduated-mesh gill nets set for 1-hour intervals. Captured fish were transported to 0.5-inch mesh holding pens and separated by sex. Equal numbers of ripe char were live-spawned into a plastic tray. The fertilized eggs were then cleaned of debris, rinsed, and stored in one-gallon polyethylene bottles. The water-hardened eggs were then iced down and transported to the Clear Hatchery for incubation and rearing.

FINDINGS

Lake And Stream Surveys In The Colville River Delta

Stream surveys were conducted in the Colville River during 16-24 June and 20-29 August 1985. Sampling during both periods was conducted by gill net and seine. In addition, baited set lines were used in June, while baited hoop nets were used in August. Sampling was conducted from the mouth of the Kikiakrorak River, downstream to the confluence with Harrison Bay in the main (Kupigruak) channel of the Colville River and, to a lesser extent, in the East channel. Smaller distributaries within the delta, including the Elaktoveach, Tamayayak, Sakoonang, and Nechelik channels, were not accessible by riverboat during either sampling period because of low flows.

Lake surveys were conducted on 16 lakes within the Colville River delta during 16 to 19 July 1985. Fish inhabited all of the lakes that were sampled.

Eighteen species of fish representing nine families were captured within the study area (Table 2). A total of 3,361 fish was captured by gill net and seine at both lake and stream sites within the study area. Species in the family Salmonidae accounted for 90% of the total harvest. The five species of whitefish found in the Colville River delta accounted for 77% of the harvest. The catch was composed of eight (44%) anadromous species, eight (44%) freshwater species, and two (12%) marine species. Anadromous species accounted for 69% of the harvest, while freshwater and marine species accounted for 29% and 2% of the harvest, respectively.

A single species, least cisco, accounted for 38% of the entire harvest. They represented 57% of the harvest in lakes, 25% of the gill-net harvest in the river, and 44% of the seine harvest in the river. While least cisco were the most numerous species captured by gill net in the river, they accounted for only 10% of the estimated biomass of the eight principal species encountered (Fig. 2). Arctic char accounted for only 11% of the catch but represented 30% of the biomass taken by gill net.

The Colville River delta appears to provide important habitats for juvenile fish during the open-water season; however, the majority of larger fish (both adult and subadult) taken by gill net appear to be transient, nonfeeding migrants. Twenty-five percent of the least cisco captured in Prudhoe Bay in 1976 (n=201) had empty stomachs (Bendock 1977), while 89% of those taken in the lower Colville River (this study) had empty stomachs (n=217). A similar incidence of empty stomachs was found in other anadromous species inhabiting the lower Colville River: broad whitefish, 76%; Arctic cisco, 98%; humpback whitefish, 64%; Arctic char, 96%; and rainbow smelt, 100%. Conversely, those species inhabiting lakes within the Colville River delta feed extensively during the open-water season. The incidence of empty stomachs in lake resident species included least cisco, 11%; broad whitefish, 6%; Arctic cisco, 50%; and humpback whitefish, 50%.

Lake and stream habitats within the delta are used for spawning by several species of freshwater and anadromous fish. Species either observed or reported to spawn in the spring include grayling, longnose sucker, rainbow smelt, slimy sculpin, Arctic lamprey, and ninespine stickleback. Species that spawn in the fall include least cisco, Arctic cisco (lakes only), broad whitefish, humpback whitefish, round whitefish, and pink salmon.

Gill-Net Stream Surveys:

A total of 1,205 fish was captured in 1,054 hours of gill-net sampling in the lower Colville River and delta. The locations of gill-net sites sampled during June and August are shown in Fig. 3. Species diversity and catch per unit effort (CPUE) were slightly higher during the second (August) sampling period. Table 3 lists the species diversity, catch,

Table 2. Family, common names, and principal life-history patterns of 18 species of fish captured in lake and stream surveys within the Colville River delta, 1985.

Family	Common Name	Occurrence		
		Freshwater	Marine/Brackish	Anadromous
Salmonidae	Least cisco			X
	Arctic cisco			X
	Broad whitefish			X
	Humpback whitefish			X
	Round whitefish	X		
	Arctic char			X
	Lake trout	X		
	Grayling	X		
	Pink salmon			X
Gadidae	Burbot	X		
Catostomidae	Longnose sucker	X		
Osmeridae	Rainbow smelt			X
Petromyzontidae	Arctic Lamprey			X
Cottidae	Slimy sculpin	X		
	Fourhorn sculpin		X	
Gasterosteidae	Ninespine stickleback	X		
Pleuronectidae	Arctic flounder		X	
Umbridae	Alaska Blackfish	X		

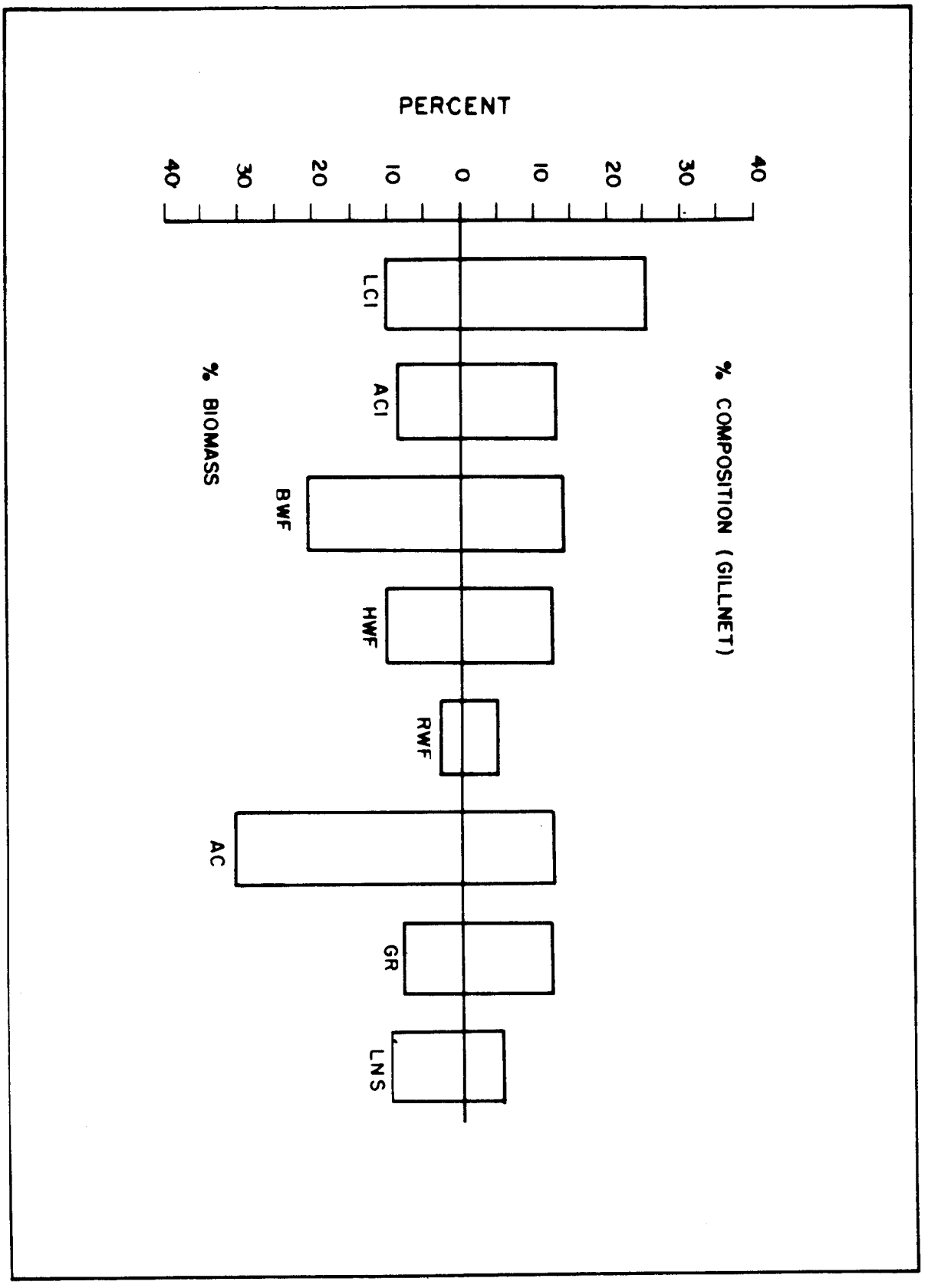

Figure 2. Percent composition and estimated biomass of 8 species of fish captured by gill net in the Colville River delta, 1985.

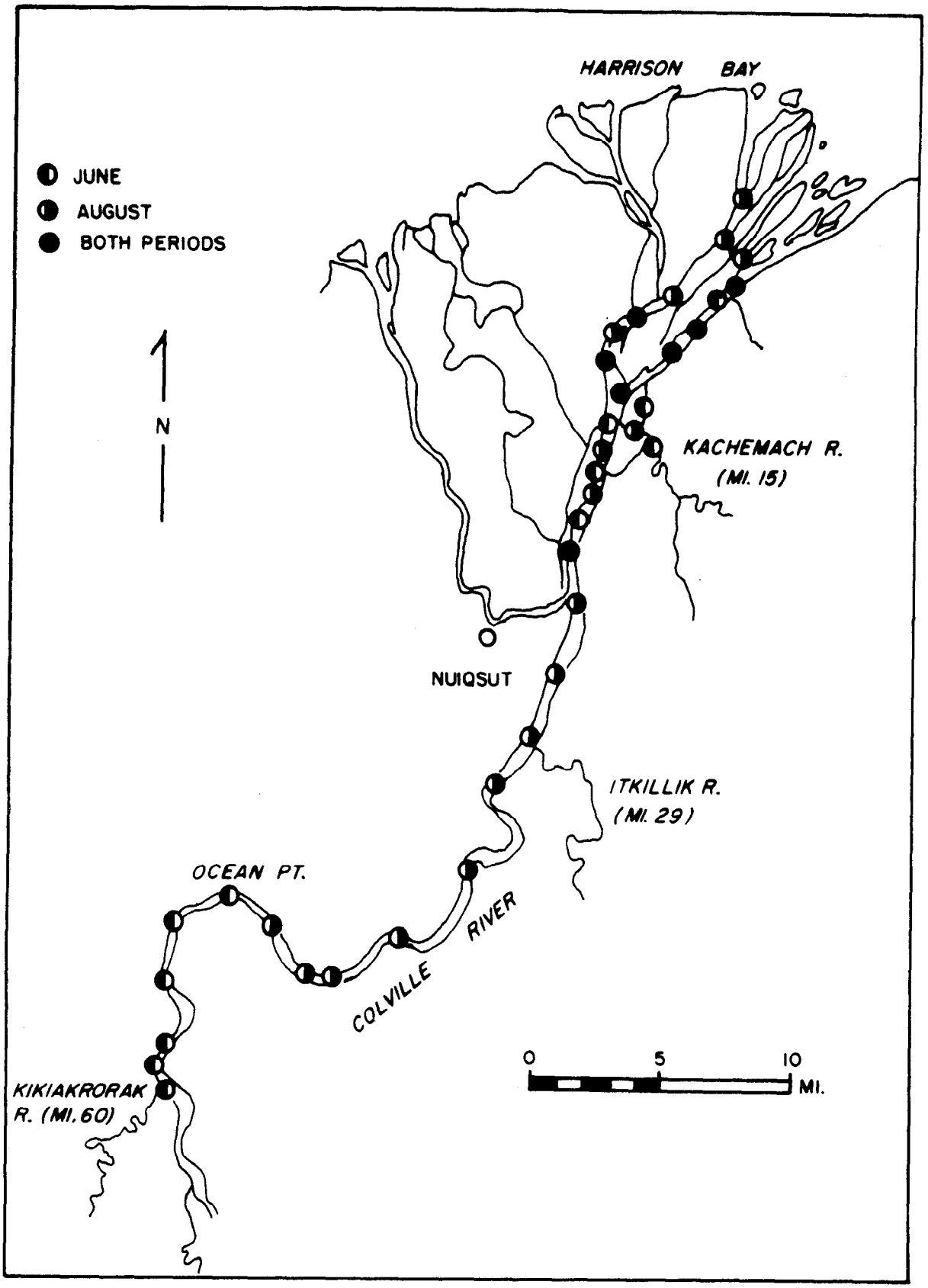

Figure 3. Locations of gill-net sample sites in the lower Colville River, 1985.

Table 3. Species diversity, effort and catch for gillnet sampling in the Colville River delta, 1985.

	Sampling Period		
	June 16-24	August 20-29	Combined Periods
Total catch	497	708	1,205
No. species	11	13	14
No. net hours	455	599	1,054
CPUE	1.09	1.18	1.14

effort, and CPUE for gill-net catches in the lower Colville River. The percent composition of the gill-net catch is illustrated in Fig. 4.

The most frequently captured species among 49 gill-net sites were broad whitefish, least cisco, and Arctic char, which were captured at 71%, 65%, and 59% of the sites, respectively. Broad whitefish and Arctic cisco were more widely distributed throughout the delta in August than in June, while grayling and longnose suckers were more widely distributed in June. Rainbow smelt were captured only in June, while pink salmon and lake trout were taken only in August. Figure 5 lists the frequency of occurrence of 13 species at 49 gill-net sites in the Colville River delta.

Seine Stream Surveys:

Beach seining was conducted throughout the study area concurrently with gill netting. Fig. 6 shows the locations of seine hauls conducted during 16-24 June and 20-29 August 1985. Seining was limited to sites with firm bottoms and water less than 3 ft deep. Ninety-one seine hauls were made within the study area, resulting in the capture of 1,787 fish. The average number of fish per haul was 19.6, with a range of 0 to 276. Seine catches made in the delta were composed of rearing fish for all species other than sculpin and rainbow smelt.

Twelve species of fish were captured by seine during June, while nine species were captured during August. Least cisco and round and humpback whitefish were the most numerous species captured, accounting for 44%, 21% and 11% of the seine haul catches, respectively. Burbot, longnose sucker, and rainbow smelt were captured during the June sampling period but were absent in August catches. Arctic cisco, which represented 12% of the gill-net harvest, accounted for less than 1% of the seine harvest.

Table 4 lists the catch composition and CPUE for 11 species of fish taken in 91 seine hauls in the Colville River delta.

Round whitefish were the most frequently occurring species captured by seine and were taken at 43% of the seine-haul sites. Least cisco and grayling were each captured at 38% of the sites, while humpback whitefish were found at 37% of the sites. Figure 7 shows the frequency of occurrence of 12 species of fish captured by seine during June and August in the Colville River delta.

Set Line and Hoop Net Stream Surveys:

Baited set lines were fished in the delta during the June sampling period, while baited hoop nets were fished during the August sampling period. Fish were captured with poor success by both methods. No fish were captured by set lines fished for 24 hook-nights within the study area.

Baited hoop nets fished for 11 trap nights captured a total of six fish (CPUE = 0.55 fish per trap night). The hoop-net catch was composed of two burbot, two fourhorn sculpin, one grayling, and one Arctic cisco.

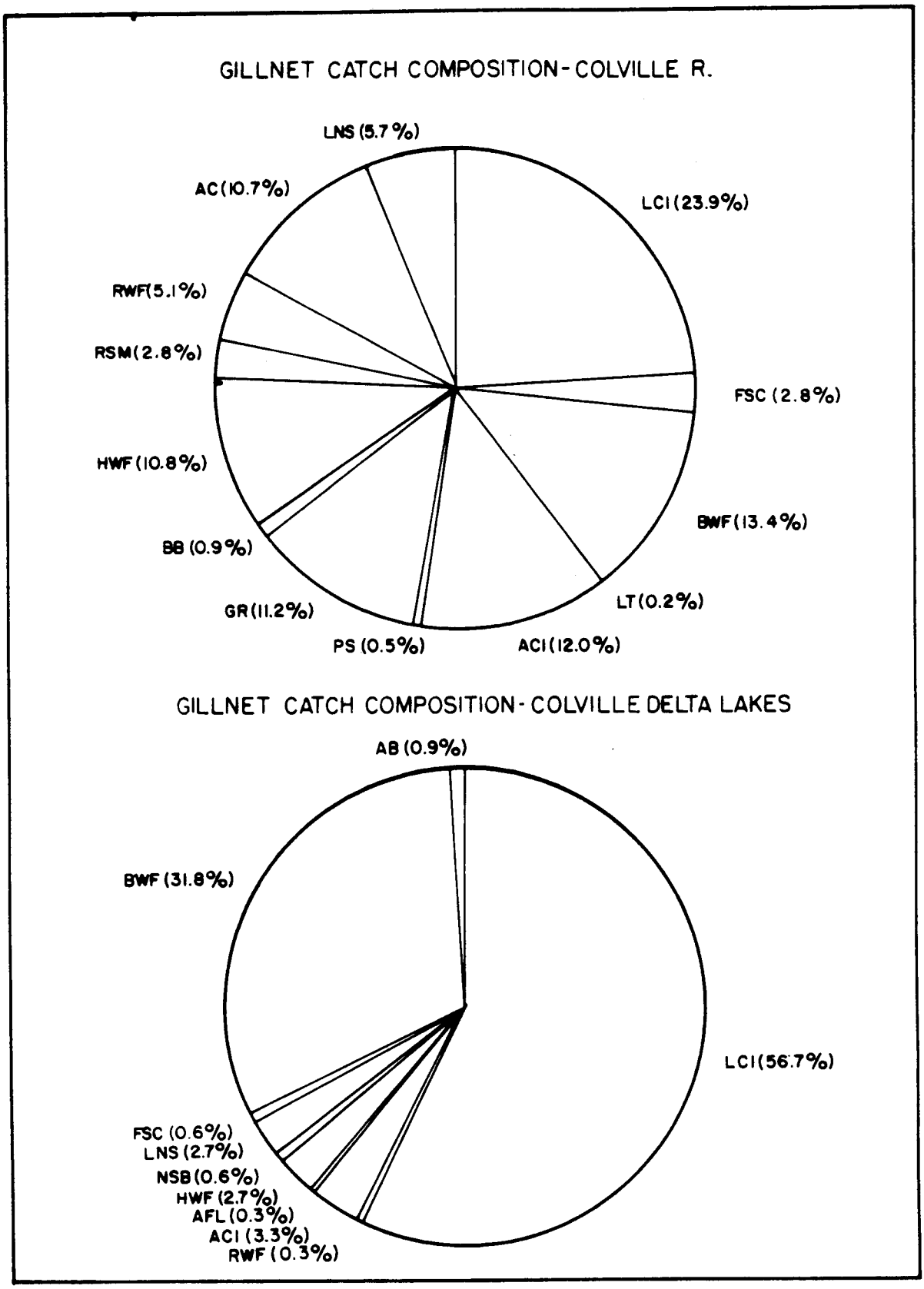

Figure 4. Composition of gill-net catches in the lower Colville River and Colville delta lakes, 1985.

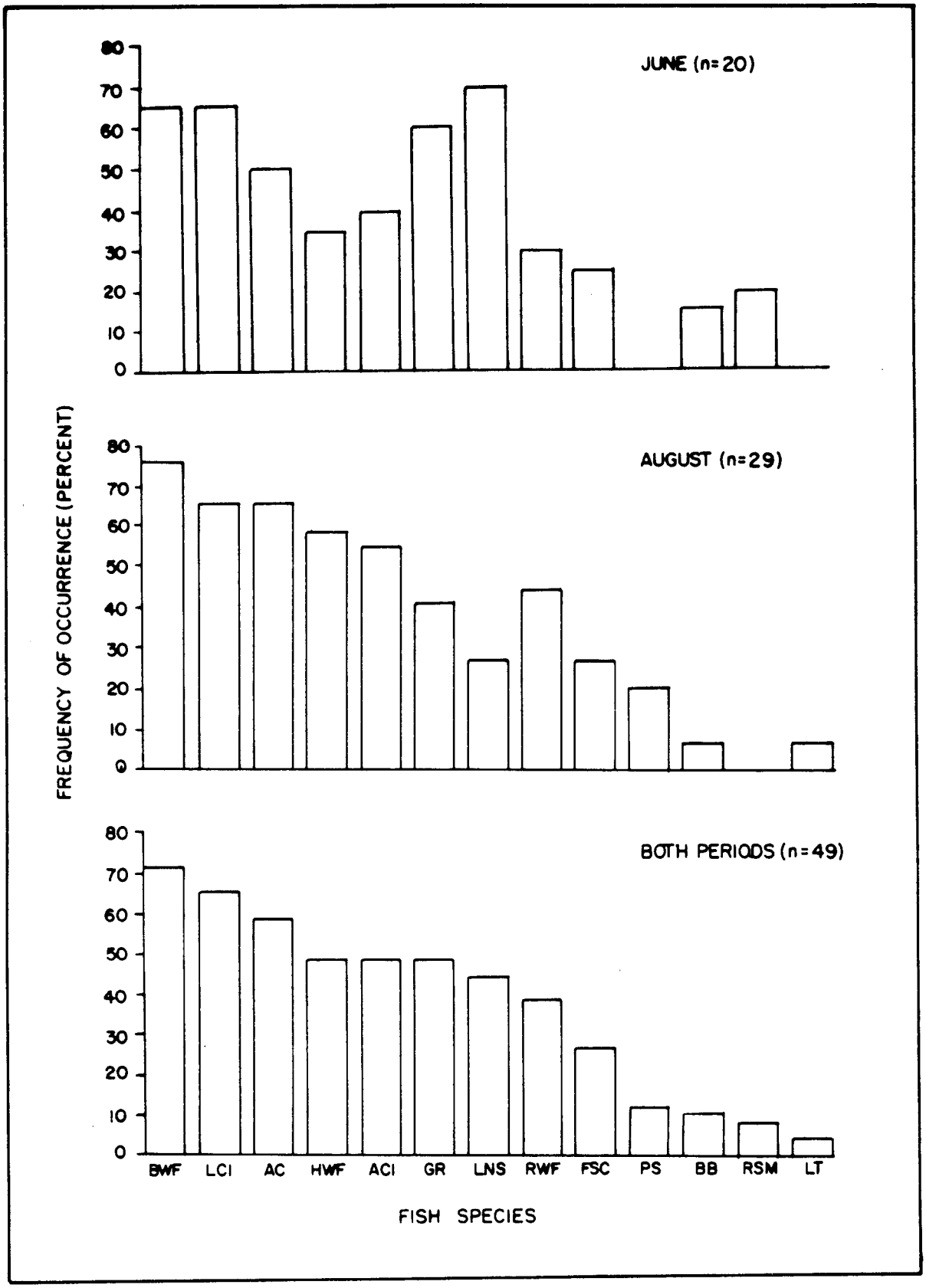

Figure 5. Frequency of occurrence of 13 species of fish captured by gill net at 49 sites in the lower Colville River, 1985.

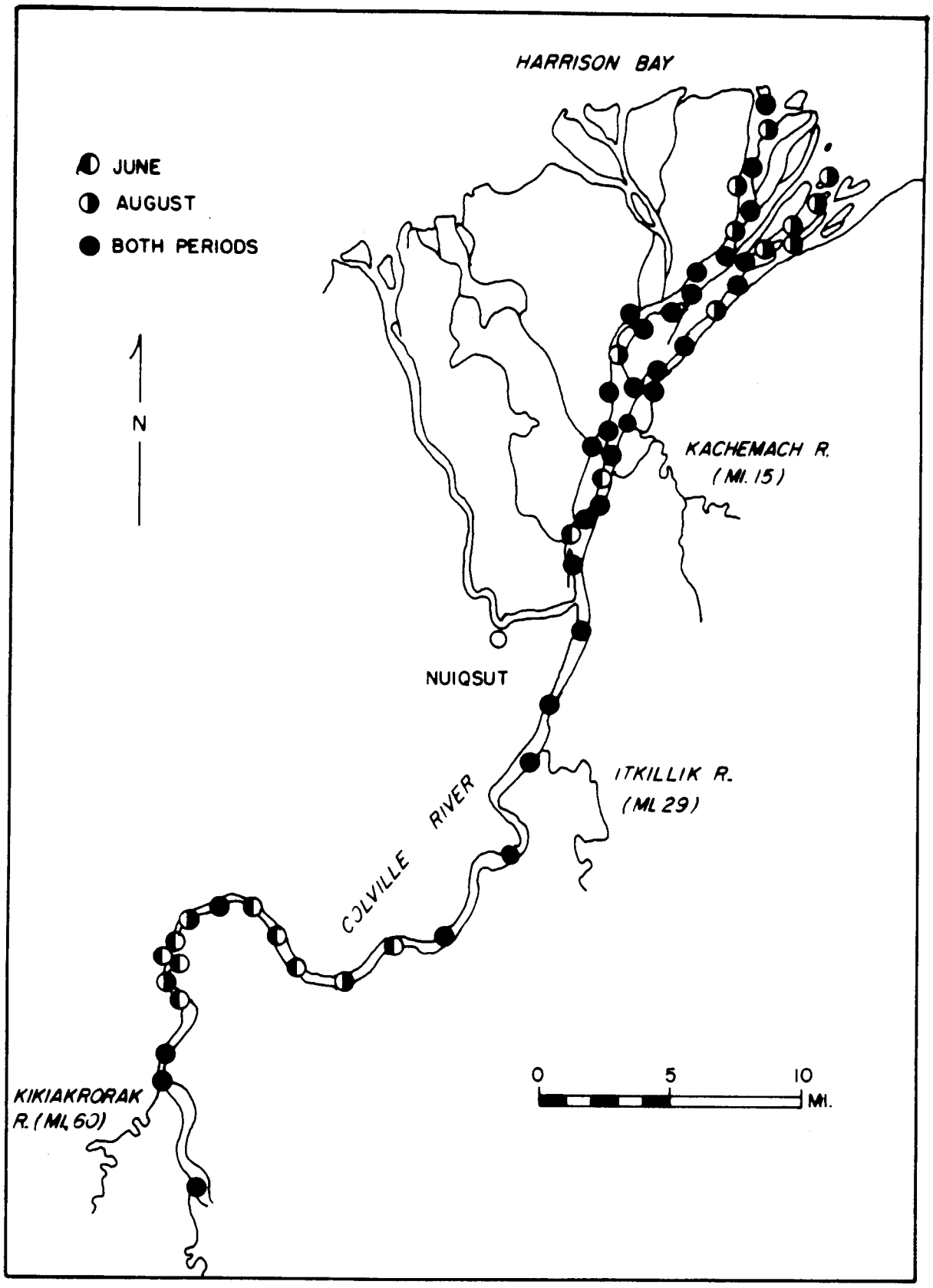

Figure 6. Locations of seine haul sites in the lower Colville River, 1985.

Table 4. Catch-per-unit-effort and composition of 91 seine hauls from the Colville River delta, 1985.

Species	No. Captured			% of Catch			CPUE (fish/haul)		
	June	Aug	Total	June	Aug	Total	June	Aug	Total
LCI	412	379	791	48	41	44	8.58	8.81	8.69
RWF	122	262	384	14	28	21	2.54	6.09	4.21
GR	116	58	174	14	6	10	2.42	1.34	1.91
SSC	80	2	82	9	<1	5	1.67	0.04	0.90
LNS	37	0	37	4	0	2	0.77	0	0.41
HWF	37	167	204	4	18	11	0.77	3.88	2.24
ACI	22	1	23	3	<1	1	0.46	0.02	0.25
BWF	16	40	56	2	4	3	0.33	0.93	0.62
RSM	5	0	5	<1	0	<1	0.08	0	0.04
FHS	2	23	25	<1	2	1	0.04	0.53	0.27
AC	1	1	2	<1	<1	<1	0.02	0.02	0.02

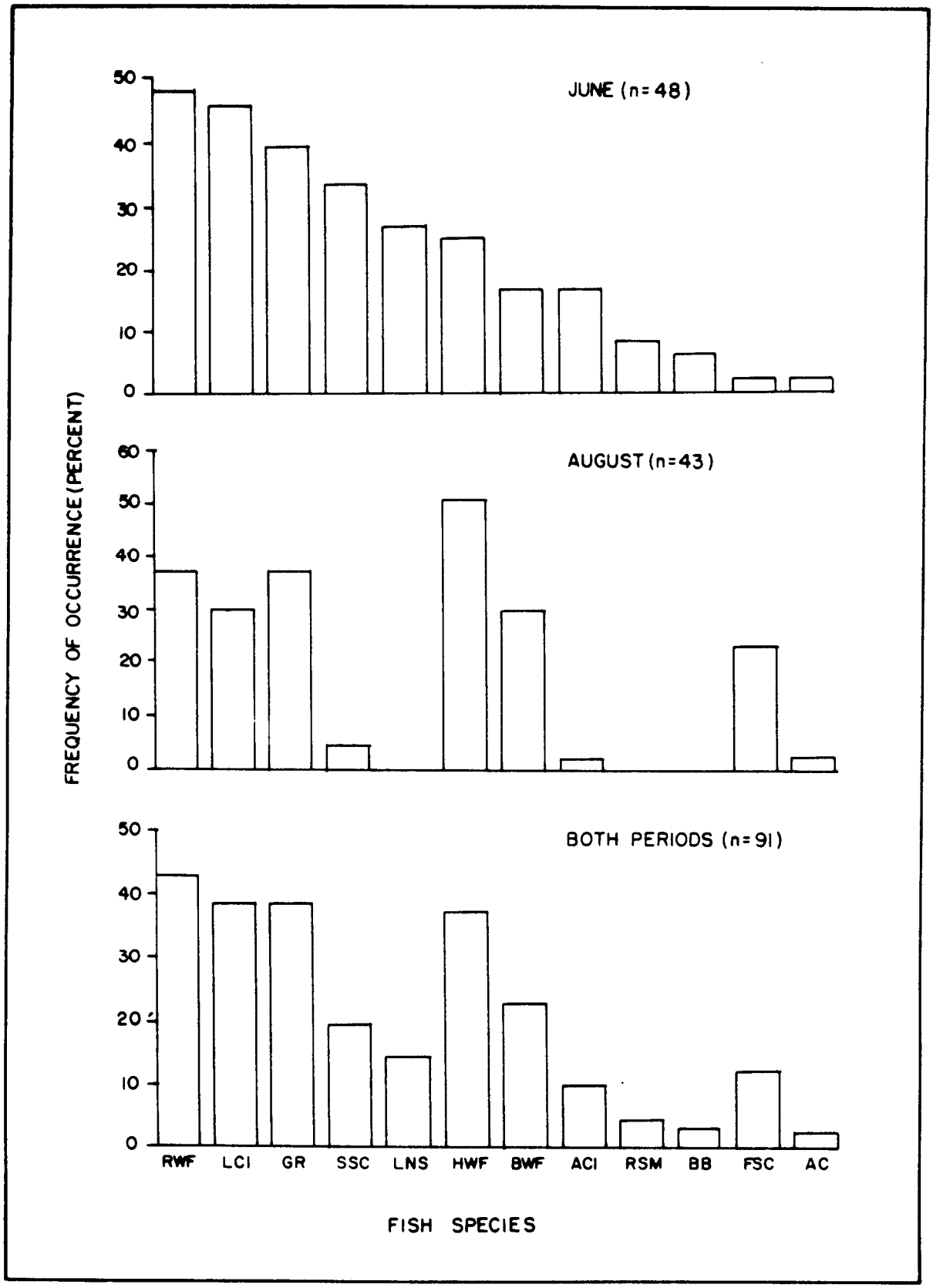

Figure 7. Frequency of occurrence of 12 species of fish captured by seine at 91 sites in the lower Colville River, 1985.

Hoop nets were baited with whitefish and set on the river bottom at depths ranging from 4 to 25 ft. Figure 8 shows the locations of hoop-net and set-line sites within the study area.

Sample Site Characteristics:

Selected water-quality parameters and site characteristics were measured at each gill-net and seine-sampling site during both sampling periods in the Colville delta. Salinity was 0.0 ppt and velocity was less than 1 fps at all gill-net sites during both periods. While the average temperature declined during August, average values for hardness ($CaCo_3$), pH, and conductivity were significantly higher ($P < 0.99$) than those obtained during June. Table 5 lists the minimal, maximal, and average values for depth, hardness, pH, conductivity, and temperature obtained at 48 gill-net sample sites in the Colville River delta. Water temperatures were only slightly warmer at seine sites than at gill-net locations, averaging 52°F (n=45) during June and 46°F (n=40) during August. There was no evidence of brackish water in the Kupigruak channel of the delta. Four seine sites in the lower reaches of the main (east) channel had salinities ranging from 1 to 3 ppt during the August sampling period.

Lake Surveys:

Lake surveys were conducted on 16 lakes within the Colville River delta (Fig. 9). Two graduated mesh gill nets were fished overnight in each lake. The nets in lake #44 were removed by a local resident, precluding our ability to obtain catch information. Fish were found in 100% of the remaining 15 lakes that were surveyed. A total of 10 species of fish was captured, including least cisco, Arctic cisco, broad whitefish, humpback whitefish, longnose sucker, Alaska blackfish, fourhorn sculpin, ninespine stickleback, Arctic flounder, and round whitefish. The percent composition of the gill-net catch from Colville delta lakes is shown in Fig. 4. The frequency of occurrence of 10 species captured in 15 lakes is shown in Fig. 10.

Because they were captured in 15 (100%) of the lakes that were surveyed, least cisco were the most abundant and frequently captured species; broad whitefish occurred in 12 (80%) of the lakes.

Lakes surveyed in the delta ranged from 80 to 580 acres in estimated surface area and from 6 to 28 ft in depth. Surface elevation ranged from 3 to 16 ft. Eleven of the lakes were landlocked and fresh; the remaining five lakes had outlets to the Colville River and salinities ranging from 0.5 to 5.0 ppt. The two marine species encountered only in lakes having outlets to the Colville River were Arctic flounder and fourhorn sculpin. Selected physical and chemical characteristics that were measured at each site are shown in Table 6.

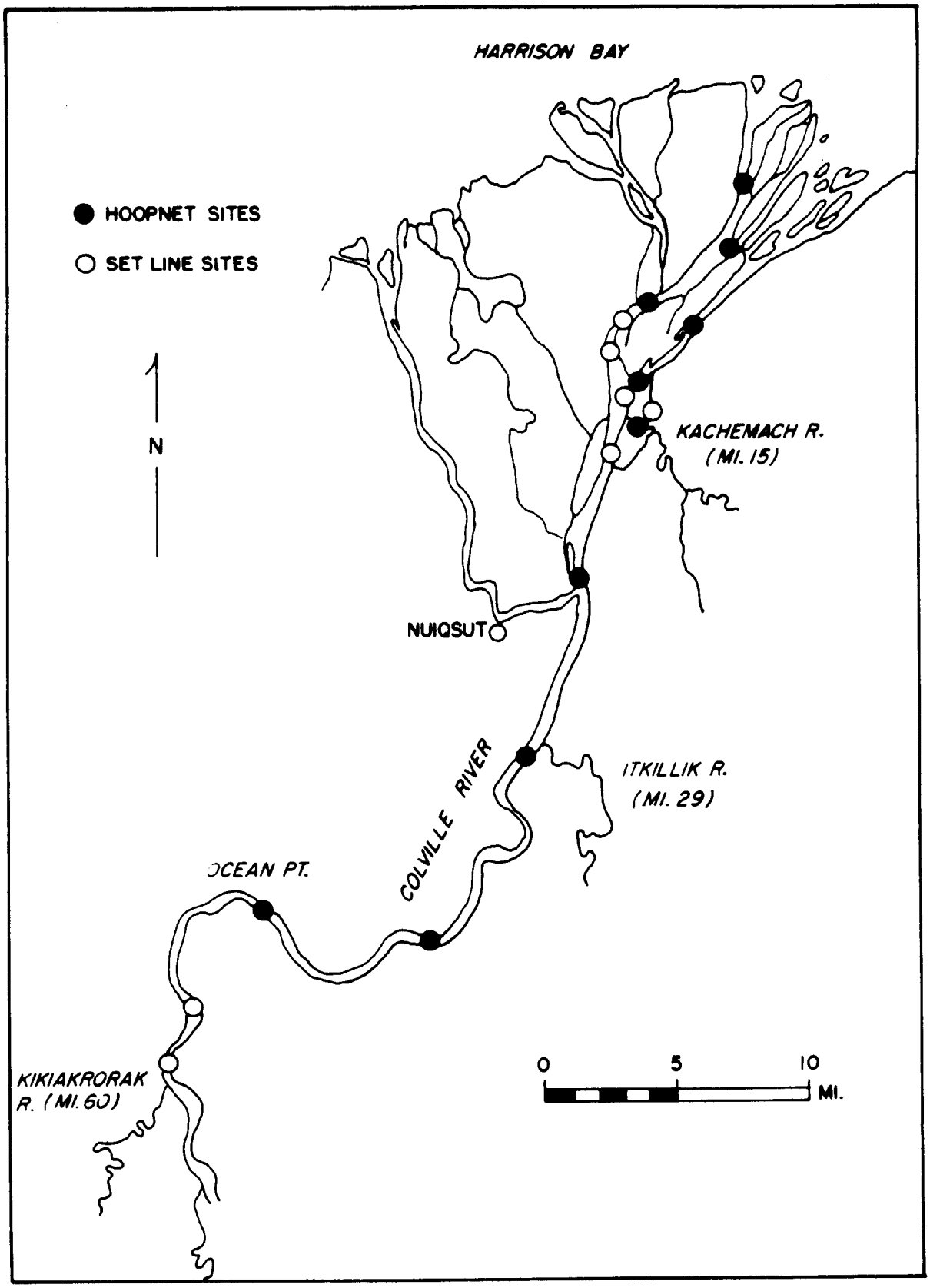

Figure 8. Locations of hoop net and set line sites in the lower Colville River, 1985.

Table 5. Selected physical and chemical values obtained at 48 gill net sample sites in the Colville River delta, 1985.

Sampling Period	No.	Depth (ft)		$CaCo_3$ Hardness ppm		pH		Conductance (micromhos)		Temp. (°F)	
		range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$
June 16-24	19	3-32	11	51-68	56	7.5-8.0	7.6	60-120	86	46-55	50
Aug. 20-29	29	4-30	12	68-103	88	7.5-8.5	8.2	80-120	96	43-50	45
Combined Periods	48	3-32	12	51-103	75	7.5-8.5	7.9	60-120	92	43-55	46

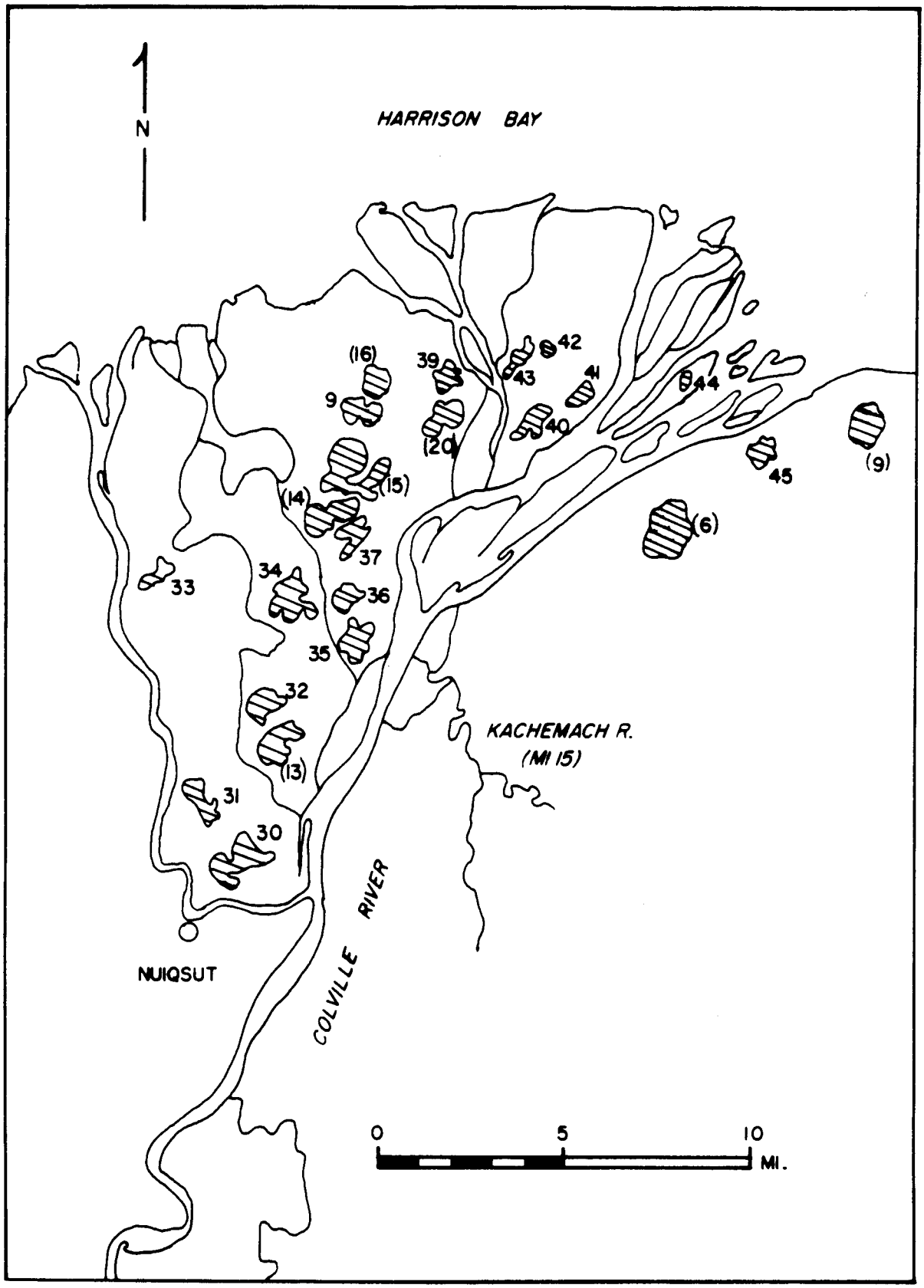

Figure 9. Locations of lakes surveyed in the Colville River delta, 1985. Lakes in parentheses surveyed by McElderry and Craig (1980).

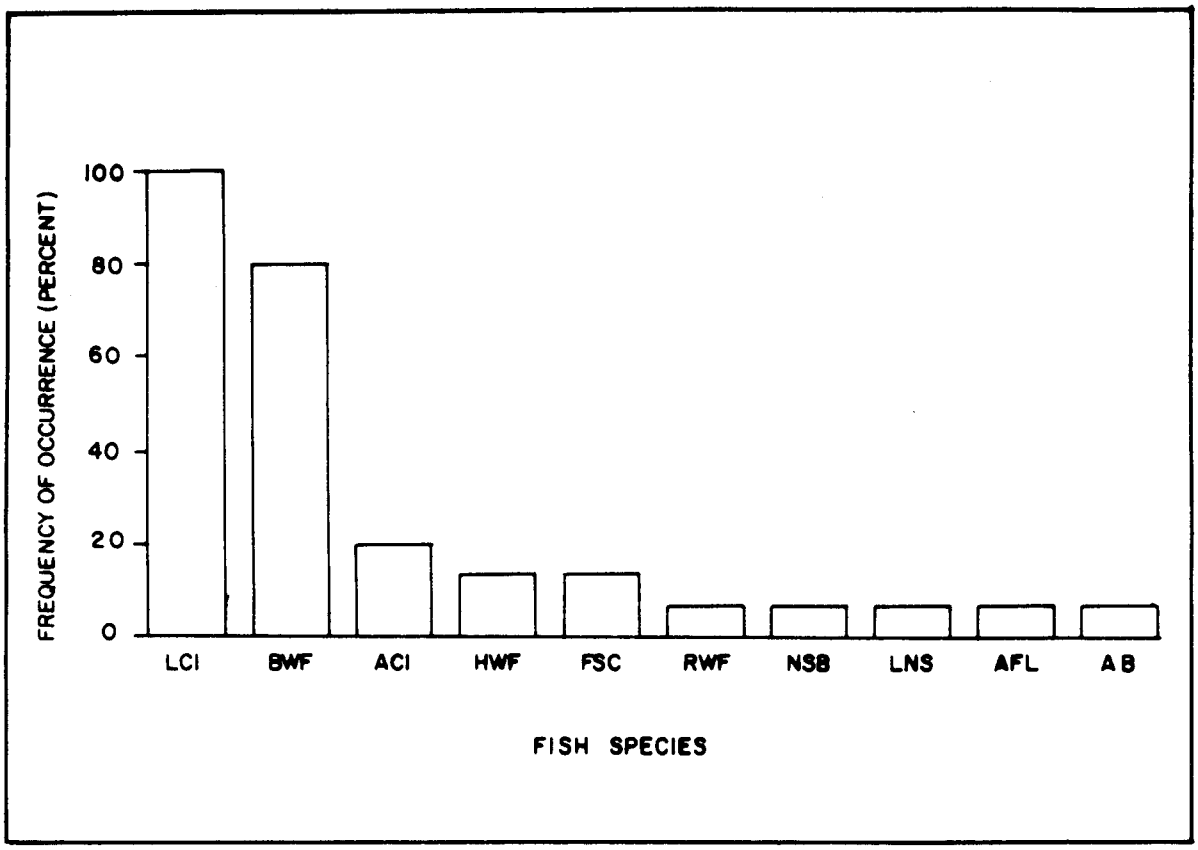

Figure 10. Frequency of occurrence of 10 species of fish captured by gill net in 15 Colville delta lakes, 1985.

Table 6. Physical and chemical characteristics and catch from Colville River delta lakes.

Lake Ref. Number	Location lat. long.	Surface Elevation (ft)	Maximum Depth (ft)	Area (acres)	Maximum Length (ft)	Shoreline** Development	Outlet Present	pH	Hardness $CaCO_3$ (ppm)	Cond.	Salinity (ppt)	H_2O Temp. (°F)	Secchi Depth (ft)	CPUE fish/hr	Species Present
30	70 14'N 150 57'W	7	10	530	8,800	2.04	No	7.5	34	40	0	49	10	1.39	BWF,HWF,LCI,NSB
31	70 16'N 150 58'W	8	8	320	7,260	1.63	No	8	51	70	0	49	5	0.42	AB,BWF,LCI
32	70 18'N 150 43'W	16	8	410	5,940	1.23	No	7.5	34	65	0	49	7	0.56	BWF,LCI
33	70 21'N 151 02'W	4	21	110	4,840	1.87	No	7.5	51	120	0	52	6	0.24	BWF,LCI
34	70 21'N 150 22'W	12	18	580	7,480	2.22	No	8.5	103	150	0	52	9	0.28	LCI
35	70 19'N 150 48'W	9	18	410	6,160	1.59	No	9	103	130	0	52	13	0.85	LCI
36	70 21'N 150 48'W	9	14	200	4,840	1.26	No	8.5	86	120	0	52	14	0.46	BWF,LCI
37	70 22'N 150 48'W	3	11	260	5,720	2.15	No	8.5	86	125	0	48	11	0.34	LCI
38	70 25'N 150 48'W	3	8	350	6,160	1.34	Yes	9	---	6,500	5	48	5	0.69	ACI,BWF,HWF,LCI
39	70 26'N 150 42'W	3	12	200	5,280	1.93	Yes	7.5	137	700	5	52	5	0.8	BWF,LCI
40	70 25'N 150 35'W	3	10	260	7,260	1.92	Yes	8.5	274	1,200	1	50	5	0.16	BWF,LCI
41	70 25'N 150 32'W	3	10	150	4,260	2.62	Yes	8.5	137	480	5	50	2	0.37	BWF,LCI,LNS,FSC
42	70 26'N 150 34'W	3	28	90	2,640	1.13	No	7.5	51	160	0	46	13	0.25	ACI,BWF,LCI
43	70 26'N 150 37'W	3	6	180	7,040	6.37	Yes	8.5	188	900	1	50	2	0.49	ACI,AFL,BWF,FSC,LCI,RWF
44	70 26'N 150 23'W	3	16	80	3,080	1.26	No	8	103	360	0	52	12	0	No Data
45	70 24'N 150 20'W	9	7	210	4,858	1.52	No	8	68	170	0	50	7	0.91	BWF,LCI
6*	70 22'N 150 26'W	8	>5	900			No							10	GR
9*	70 25'N 150 12'W	12	>7	450			No							4	None Captured
13*	70 17'N 150 53'W	7	--	470			No							---	BWF,HWF,LCI,RWF
14*	70 22'N 150 50'W	3	--	560			Yes							5.3	LCI
15*	70 24'N 150 48'W	3	--	1,000			Yes							4.6	ACI,BSM,BWF,FSC,LCI,SCD
16*	70 26'N 150 47'W	3	--	310			Yes							0	AC,ACI,BSM,BWF,FSC,LCI
20*	70 25'N 150 42'W	3	--	360			Yes							0.1	ACI,AFL,BSM,BWF,FSC,HWF,LCI

* Surveyed by McElderry & Craig (1980)

** $\frac{\text{Shoreline Length}}{2} \times \sqrt{\text{area} \times 3.14}$

Least Cisco - River:

Distribution and abundance. Least cisco are common inhabitants of the Colville River drainage, occurring in both lakes and streams as well as brackish coastal habitats. They occur as resident, freshwater populations in lakes across the North Slope, inhabiting waters ranging from sea level to 2,100 ft in surface elevation (Bendock and Burr 1985a). Stream populations of least cisco exhibit varying degrees of anadromy and occupy streams west of the Colville River (Arctic coastal plain). They are found in coastal waters (during the open-water season) from Pt. Barrow to the Canadian Border; however, their greatest abundance appears to be in coastal waters within 100 mi of the Colville River delta. Least cisco were the most abundant anadromous species captured in several recent fisheries investigations in areas such as the western Beaufort Sea (Schmidt et al. 1983), the Arctic Coastal Plain (Bendock and Burr 1985b), and Prudhoe Bay (Bendock 1977).

A total of 1,087 least cisco was captured by seine and gill net at stream sites within the study area. They were the most numerous species captured, accounting for 25% of the gill-net harvest in the river and 44% of the seine harvest. The catch per net hour of least cisco taken by gill net was 0.28 and the catch per seine haul was 8.69.

Least cisco were captured by gill net throughout the lower 50 mi of the Colville River during June as well as August. Least cisco were captured by seine throughout the lower 50 mi of the Colville River during June; however, August seine catches revealed a less widespread distribution of rearing least cisco, with catches occurring in only the lower 15 mi of river. The largest seine catches of rearing least cisco occurred in the vicinity of the Itkillik River (mi 30) during June, while in August the largest catches occurred in the lower 5 mi of the East channel of the delta.

Growth and Maturity. Fork lengths of least cisco captured by gill net ranged from 120 to 360 mm and averaged 260 mm. Weights averaged 189 g and ranged from 20 to 475 g. Fig. 11 shows the length-frequency distributions of least cisco captured by gill net and seine in the Colville River and by gill net in lakes of the Colville delta.

Ages of least cisco captured in the Colville River ranged from 0 (young-of-the-year) to 12 years. The predominant age class in the gill-net sample was 6, corresponding to fish averaging 251 mm in fork length. Sexual maturity was first reached at age 5, and 100% of the sample was mature by age 8. The growth rate of least cisco captured in this study is generally similar to that found in other Beaufort Sea investigations (Bendock 1977; Craig and Haldorson 1980). Sexual maturity for least cisco was attained at a slightly earlier age than that reported from samples obtained in Simpson Lagoon (Craig and Haldorson 1980). Table 7 shows the age-specific lengths and maturity of least cisco sampled from the Colville River.

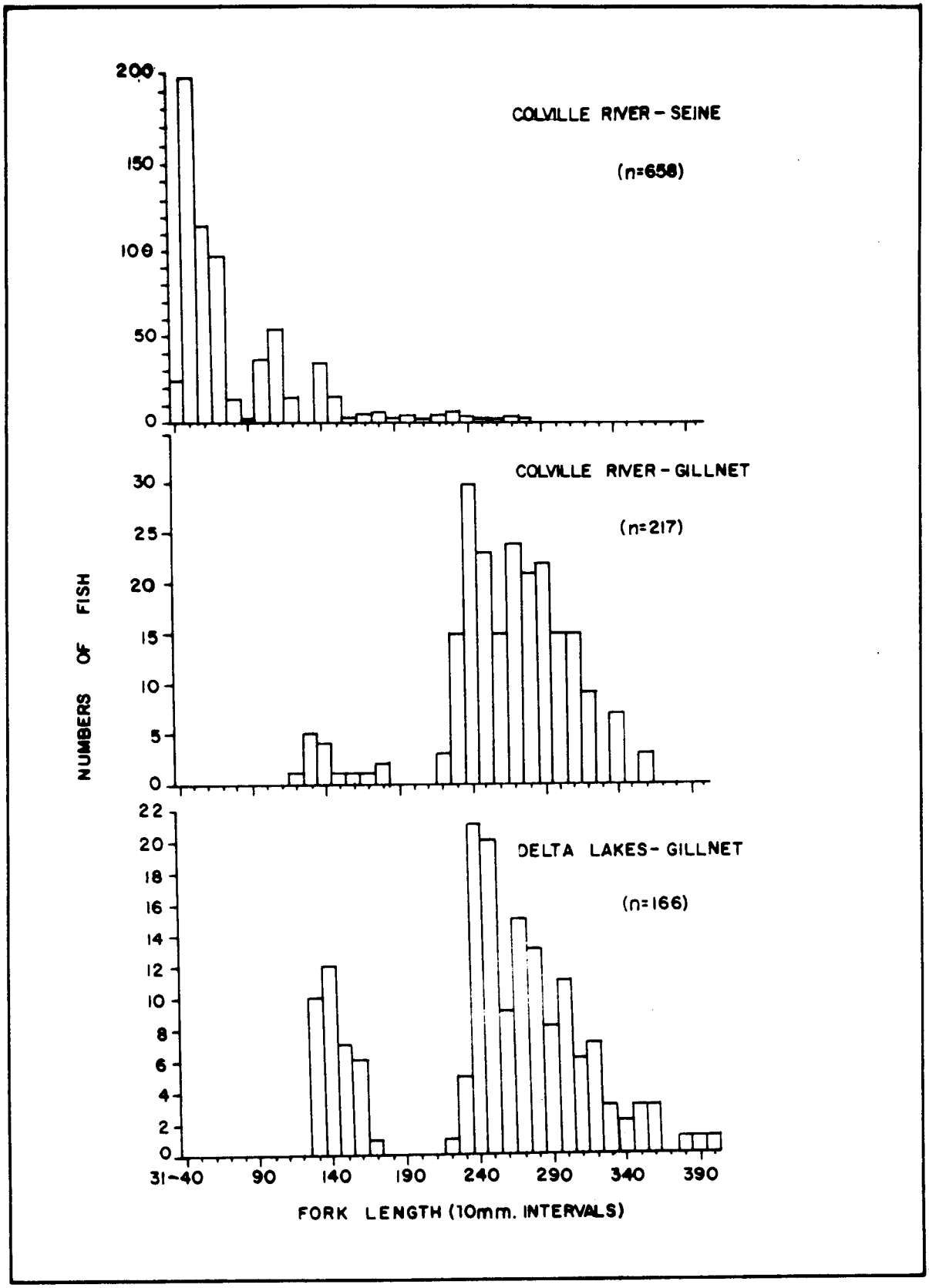

Figure 11. Length-frequency distributions of least cisco captured by gill net and seine in the Colville River and by gill net in 15 delta lakes, 1985.

Table 7. Age-length relationship and maturity of 274 least cisco captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	3	63	56-72	6.60	0
1	23	66	52-105	16.76	0
2	25	108	97-132	9.81	0
3	24	139	127-164	8.72	0
4	8	167	140-190	15.66	0
5	29	234	176-267	20.18	72
6	83	251	219-304	19.46	73
7	41	282	245-315	16.56	85
8	22	302	281-332	15.10	100
9	9	312	291-360	19.72	100
10	5	343	332-357	9.70	100
11	1	(333)			0
12	1	(338)			100

The male-to-female sex ratio of 206 least cisco was 1.24:1. Ovaries were removed from nine prespawning least cisco between 27-28 August 1985. Fecundity ranged from 8,125 to 23,370 eggs and averaged 14,732. Egg diameters ranged from 1.3 to 1.6 mm and averaged 1.45 mm. Table 8 lists the size, age, and fecundity of nine least cisco captured in the Colville River delta.

Least cisco are generally thought to spawn in the main stem of the Colville River between Ocean Point and Harrison Bay (McEldery and Craig 1980). In our investigation, mature prespawning least cisco were captured throughout the study area during the August sampling period. The first spawning female least cisco was captured near Ocean Point in 45° F water on 21 August 1985; however, it appeared that most least cisco had not yet commenced spawning by the end of August. Spawning (ripe) least cisco were captured only between the Itkillik River and Ocean Pt. Least cisco are reported to spawn in the Ikpikpuk River drainage during the second week of September and in water temperatures ranging from 36° F to 39° F (Bendock and Burr 1984).

The majority (89%) of least cisco captured by gill net had empty stomachs (n=217). Zooplankters were found in 8% of the least cisco stomachs, while amphipods, mysids, and dipteran larvae were found in 3% of the stomachs.

Least Cisco - Lakes:

Least cisco were captured in 15 (100%) of the lakes that were surveyed. A total of 187 was captured in 622 hours of netting, yielding a CPUE of 0.3 fish/hour. Fork lengths of 166 least cisco ranged from 123 to 393 mm and averaged 244 mm. Weights ranged from 30 to 725 g and averaged 179 g.

Ages of least cisco from Colville delta lakes ranged from 2 through 20 years. The age-length relationship and maturity of least cisco taken in lakes are shown in Table 9. Forty-eight percent of the least cisco sampled were mature. Age at first maturity was 6 years, and 89% of age-class-11 fish were mature. The male to female sex ratio was 0.9:1.

The majority (89%) of least cisco captured in Colville delta lakes were feeding. Dipteran larvae and adults were the most frequently occurring food item, followed by zooplankton, snails, caddis larvae, clams, fish and isopods.

Broad Whitefish - River:

Distribution and abundance. Broad whitefish are distributed throughout the Colville River drainage between Harrison Bay and the Ipnavik River. They also inhabit estuaries and nearshore coastal habitats along the central and western Beaufort Sea. Anadromous, stream-resident, and lake-resident forms of broad whitefish occur in the Colville River drainage. Large numbers of prespawning broad whitefish migrate up the Colville River past Umiat during August (Kogl 1971; Bendock 1979); however, it is not known if these fish are freshwater residents or anadromous. Lake-resident forms inhabit the Killik and Etivluk River drainages and are abundant in lakes along the Arctic coastal plain north and west of the Colville River.

Table 8. Size, age, and fecundity of nine least cisco captured in the Colville River delta, 1985.

Date	Fork Length (mm)	Weight (g)	Age Class	Egg Dia. (mm)	Fecundity
Aug. 27	262	200	6	1.6	8,125
Aug. 28	250	150	6	1.3	8,800
Aug. 28	266	210	6	1.5	13,130
Aug. 27	270	200	6	1.4	13,824
Aug. 28	270	200	6	1.5	10,500
Aug. 27	290	250	7	1.3	15,360
Aug. 27	310	350	7	1.6	18,425
Aug. 27	320	350	8	1.5	21,054
Aug. 27	332	350	8	1.4	23,370

Table 9. Age-length relationship and maturity of 167 least cisco captured in the Colville River delta lakes during July 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
2	6	137	126-152	9.71	0
3	4	131	123-138	6.24	0
4	21	138	124-162	10.87	0
5	5	145	133-160	9.91	0
6	26	244	229-281	11.38	58
7	23	250	217-342	27.85	74
8	32	278	232-359	34.40	53
9	19	284	146-393	48.23	42
10	10	280	241-317	23.43	100
11	9	300	267-352	25.35	89
12	6	293	274-323	20.46	100
13	1	(336)		0	100
14	1	(318)		0	100
15	1	(310)		0	100
16	2	348	345-350	2.50	100
20	1	(390)		0	100

A total of 218 broad whitefish was captured by seine and gill net in the Colville River. Broad whitefish were the second most abundant fish taken by gill net in the Colville River delta (Fig. 4), accounting for 14% of the gill-net harvest but only 3% of the seine harvest within the study area. With a corresponding increase in CPUE, more than twice as many broad whitefish were taken by gill net and seine in August than in June. Broad whitefish were the most frequently encountered species taken by gill net, occurring in 71% of the 49 sample sites. Rearing broad whitefish, however, were less widely distributed throughout the delta and were captured at less than 25% of the 91 seining sites.

Growth and maturity. Broad whitefish inhabiting Beaufort Sea drainages are slow growing and long lived. They are late maturing and appear to spawn either nonconsecutively or intermittently. Broad whitefish taken by gill net were predominantly (75%) subadult migrants that were not feeding (76% had empty stomachs); fork lengths ranged from 112 to 591 mm and averaged 317 mm. Weights ranged from 20 to 2,700 g and averaged 703 g. Broad whitefish captured by seine ranged from 53 to 160 mm and averaged 74 mm in fork length. Fig. 12 shows the length-frequency distribution of broad whitefish captured by gill net and seine in the Colville River.

Ages of broad whitefish ranged from young-of-the-year to 17 years. The predominant age class in the gill net sample was 6, corresponding to fish averaging 312 mm in fork length. Sexual maturity was first reached at age 8; however, all samples within an age class were not mature until age 15. The male-to-female sex ratio of 132 broad whitefish was 0.94:1. Table 10 lists the age, lengths and maturity of broad whitefish captured in the Colville River delta.

During our survey, there was no evidence that broad whitefish spawn in the lower delta of the Colville River. Kogl and Schell (1975) found small numbers of broad whitefish spawning in the delta in close proximity to humpback whitefish during early October. Bendock (1979) found broad whitefish spawning throughout the middle reaches of the Colville River.

Ovaries were removed from four prespawning broad whitefish captured in the vicinity of Umiat during late August 1985. Egg diameters ranged from 2.3 to 2.6 mm and averaged 2.5 mm. Fecundity ranged from 25,800 to 43,860 eggs and averaged 35,659 eggs. Table 11 shows the size, age, and fecundity of four broad whitefish taken in the Colville River.

The majority (76%) of broad whitefish sampled by gill net had empty stomachs (n=134). Food items in descending frequency of occurrence included dipteran larvae (21.5%), zooplankters, (1.5%) and mysids (0.7%).

Broad Whitefish - Lakes:

A total of 105 broad whitefish was captured in 12 (80%) of the lakes that were surveyed. They were the second-most-abundant species captured, accounting for 32% of the gill-net harvest (Fig. 4). Broad whitefish ranged from 130 to 626 mm and averaged 380 mm in fork length.

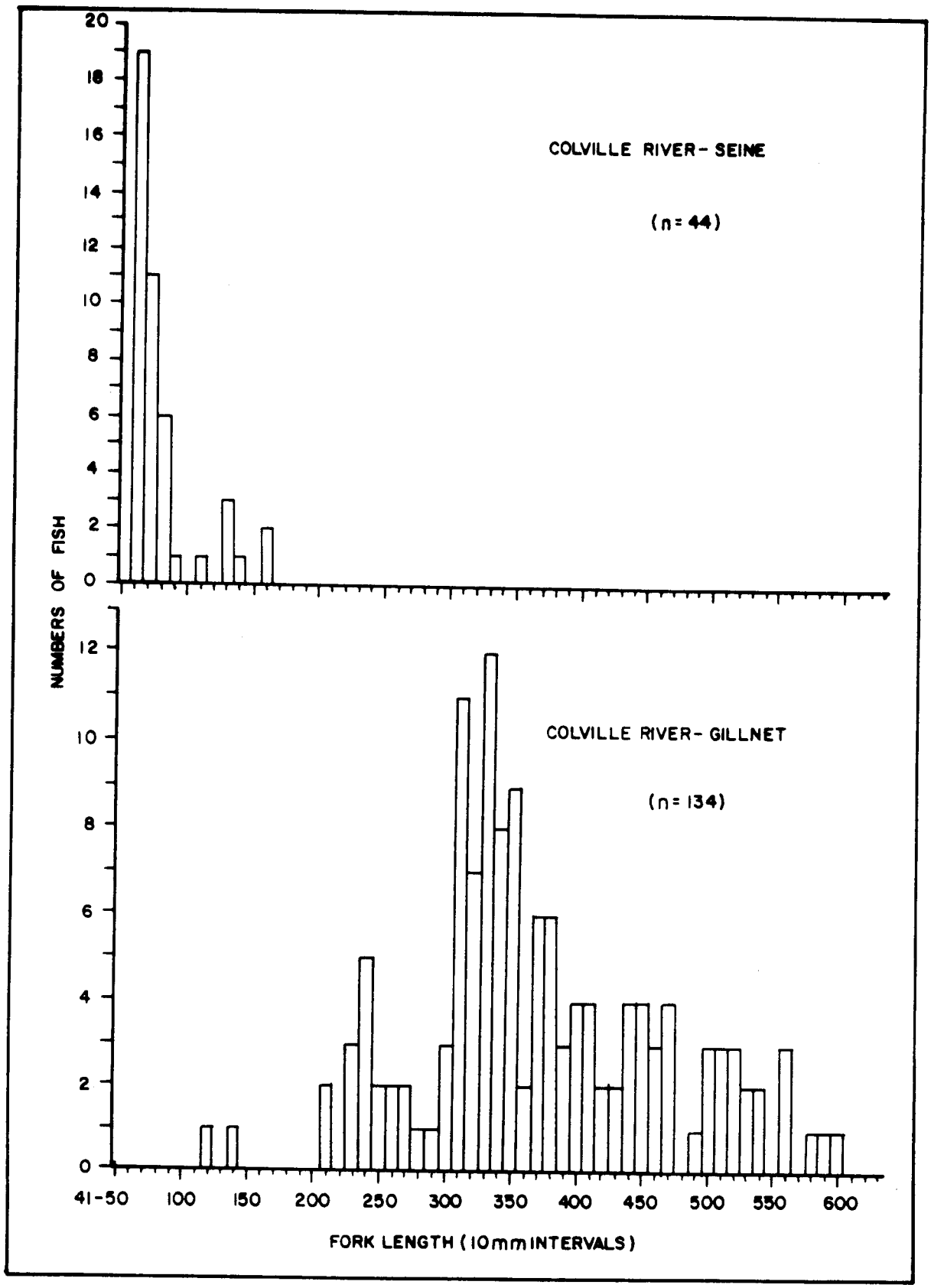

Figure 12. Length-frequency distributions of broad whitefish captured by seine and gill net in the lower Colville River, 1985.

Table 10. Age-length relationship and maturity of 144 broad whitefish captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	1	(71)			
1	3	126	121-131	4.11	0
2	3	149	131-160	13.02	0
3	1	(204)			0
4	8	234	204-250	12.72	0
5	7	279	240-374	40.81	0
6	32	312	233-372	21.91	0
7	21	341	312-396	20.75	0
8	13	385	336-500	39.42	8%
9	15	376	322-443	37.61	0
10	10	427	374-452	23.71	20
11	9	466	421-507	29.42	78
12	9	490	415-538	43.86	78
13	3	489	430-523	42.08	67
14	4	477	424-506	31.88	75
15	2	564	553-575	11.00	100
16	2	574	557-590	16.50	100
17	1	(591)			100

Table 11. Size, age, and fecundity of four broad whitefish captured in the Colville River delta, 1985.

Date	Fork Length (mm)	Weight (g)	Age Class	Egg Dia. (mm)	Fecundity
Aug. 30	481	1,600	12	2.3	25,800
Aug. 29	523	2,050	13	2.4	43,860
Aug. 30	530	1,975	16	2.5	34,500
Aug. 30	535	2,250	15	2.6	38,475

Weights ranged from 50 to 5,000 g and averaged 940 g. The length-frequency distribution of 98 broad whitefish captured in Colville delta lakes is shown in Fig. 13.

Ages of broad whitefish ranged from 2 to 18 years. Table 12 lists the age, length, and maturity of broad whitefish captured in Colville delta lakes. Sixteen percent of the fish sampled from lakes were mature. Age at first maturity was 9 years; however, a number of older fish had undeveloped gonads, which may indicate that spawning is nonconsecutive. The male-to-female sex ratio was 1.1:1.

The majority (94%) of broad whitefish that were sampled had food in their stomachs. Stomach contents in descending frequency of occurrence included dipteran larvae, 52%; clams, 32%; snails, 4%; caddis larvae, 3%; grubs, 2%; and amphipods, 1%.

Arctic Cisco - River:

Distribution and abundance. The Arctic cisco is one of the most abundant species inhabiting coastal waters of the Beaufort Sea during the open-water season. They do not inhabit inland waters of northern Alaska but have been found in Teshekpuk Lake, several lakes within the Colville River delta, and the lower reaches of the Colville and Sagavanirktok Rivers. To date, there have been no spawning populations of anadromous Arctic cisco located in Alaskan waters; thus, it has been postulated that Arctic cisco in Alaska are representatives of a Canadian stock from the Mackenzie drainage.

Arctic cisco within the study area were distributed throughout the Colville River between Ocean Point and Harrison Bay. A total of 172 Arctic cisco was captured by seine and gill net. They were the third most abundant species captured by gill net, accounting for 12% of the catch. The CPUE of Arctic cisco taken by gill net was 0.14 fish/hour, and the CPUE was slightly higher in June than in August. Arctic cisco were captured at 24 (49%) of the 49 gill-net sites.

Arctic cisco accounted for 1% of the seine catch and were found at 9 (10%) of the 91 seine-haul sites.

Growth and maturity. Arctic cisco ranged from 151 to 390 mm in fork length and averaged 291 mm (n=130). Weights ranged from 30 to 750 g and averaged 283 g. Fig. 14 shows the length-frequency distribution of 130 Arctic cisco captured in the Colville River delta.

Ages of Arctic cisco ranged from 2 to 8 years. The catch was dominated by 5-and 6-year-old fish, which accounted for 77% of the catch. Age classes 0, 1, 3, and 4 were absent in the catch. Table 13 shows the age, size, and maturity of Arctic cisco captured in the Colville River; all of the fish were immature. The male-to-female sex ratio of 129 Arctic cisco was 0.82:1. Total gill-raker counts from the first arch on the left side of 38 Arctic cisco were obtained. The number of gill rakers ranged from 38 to 46, with a mode of 40 and average of 41.3

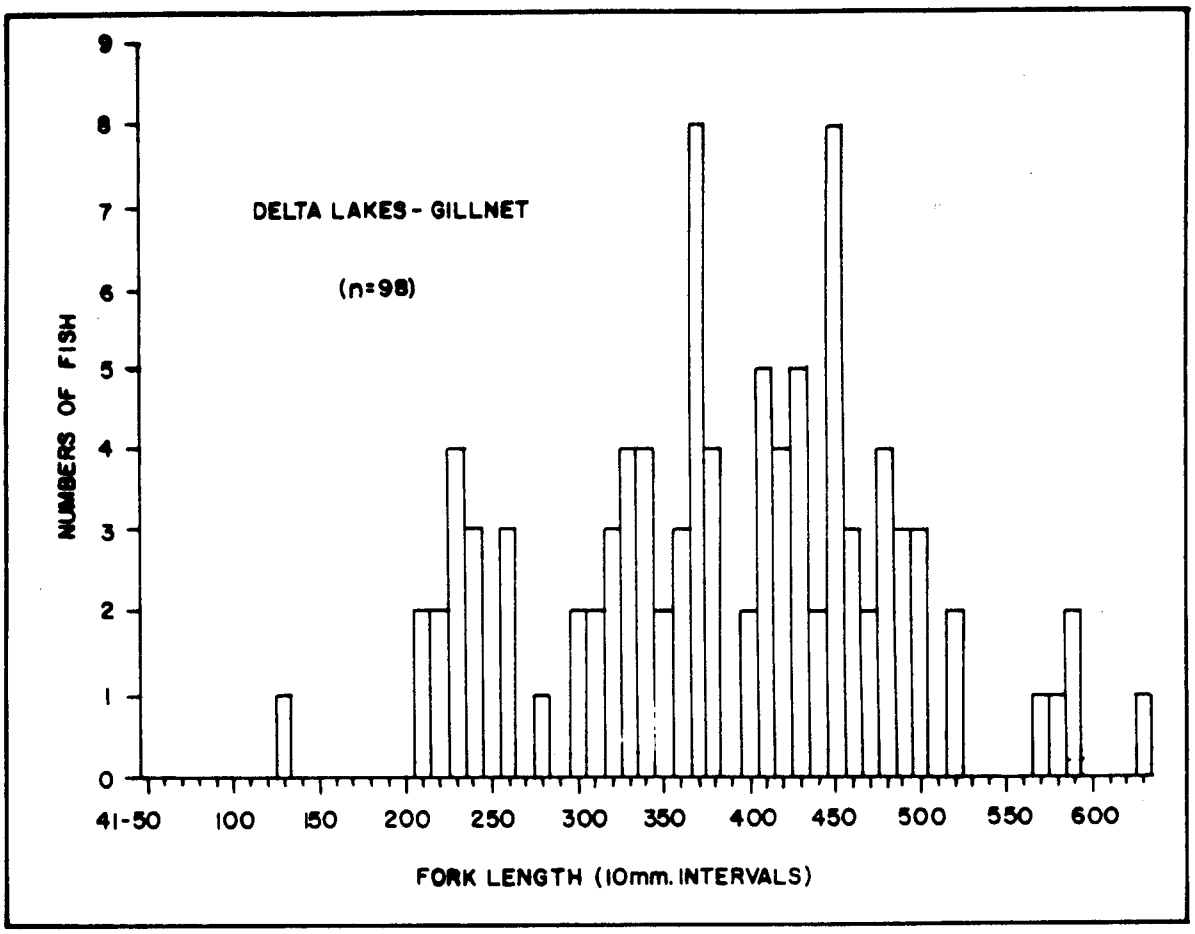

Figure 13. Length-frequency distribution of broad whitefish captured by gill net in 15 Colville delta lakes, 1985.

Table 12. Age-length relationship and maturity of 97 broad whitefish captured in Colville delta lakes during July 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
2	1	(130)		0	0
3	2	215	209-220	5.50	0
4	7	223	206-233	9.46	0
5	1	(235)	-	0	0
6	6	272	232-312	30.01	0
7	6	279	247-329	29.41	0
8	19	393	313-461	45.07	0
9	23	392	302-485	56.76	13
10	9	409	352-472	43.98	0
11	5	402	370-447	30.20	20
12	8	442	376-520	46.33	25
13	1	473	-	0	100
14	3	515	485-563	34.47	100
15	2	482	473-491	9.00	50
16	0	-	-	-	-
17	0	566	520-589	32.29	100
18	1	(626)	-	0	100

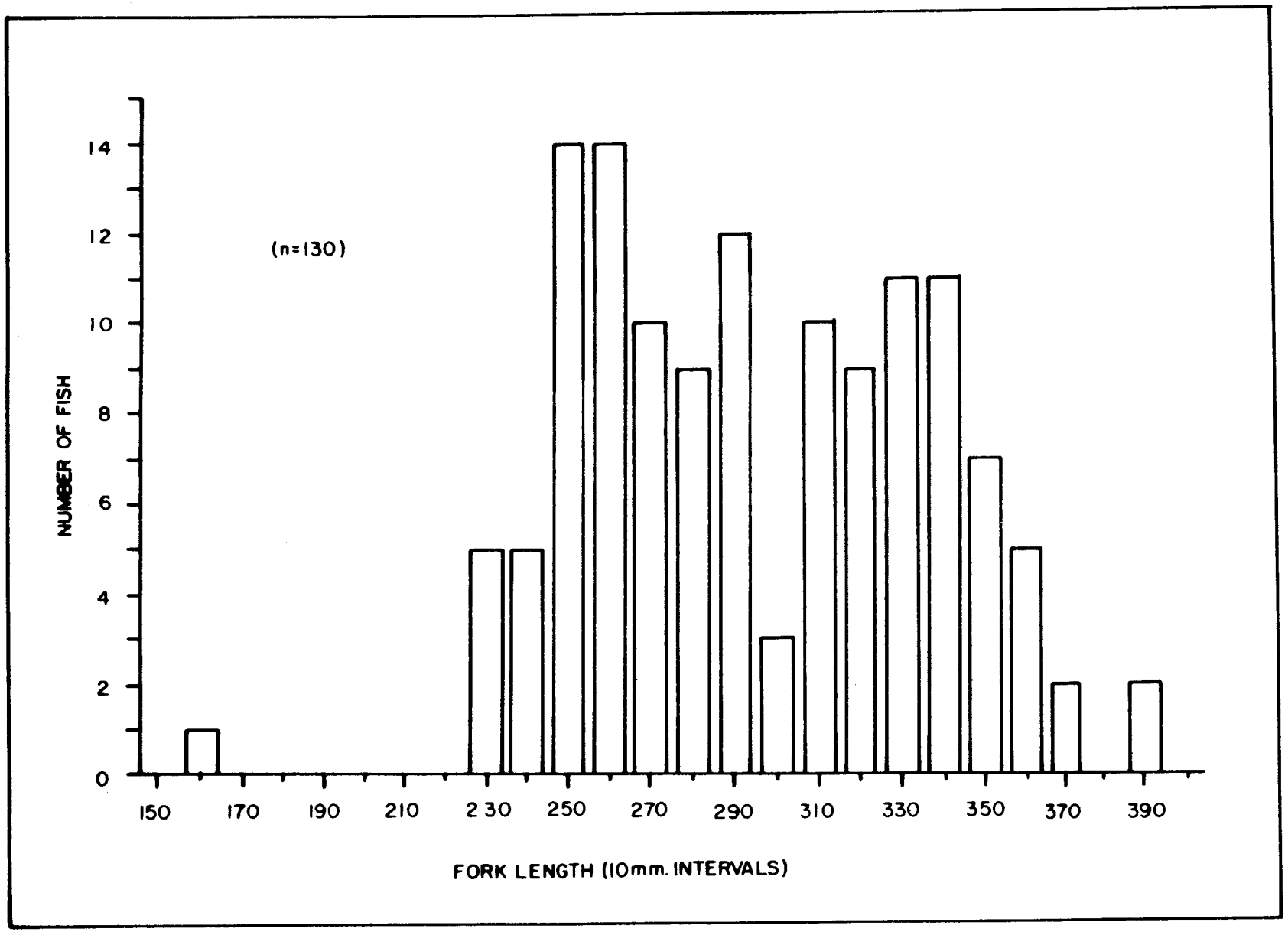

Figure 14. Length-frequency distribution of Arctic cisco captured by gill net in the lower Colville River, 1985.

Table 13. Age-length relationship and maturity of 133 Arctic cisco captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
2	4	145	130-162	12.74	0
3	0				
4	0				
5	45	258	226-325	22.95	0
6	57	298	245-354	30.25	0
7	23	334	278-389	26.46	0
8	4	360	338-390	21.04	0

Ninety-eight percent of the Arctic cisco captured had empty stomachs. Amphipods were found in 1.5% of the stomachs, while mysids were found in 0.8%.

Arctic Cisco - Lakes:

Eleven Arctic cisco were captured in three (20%) of the Colville delta lakes that were surveyed, representing 3% of the total gill-net catch. Fork lengths ranged from 267 to 371 mm and averaged 305 mm. Weights ranged from 125 to 500 g and averaged 283 g.

Arctic cisco ranged in age from 6 to 9 years. Table 14 shows the age, length, and maturity of Arctic cisco captured in Colville delta lakes. Twenty percent of the sampled fish were mature; maturity first occurred at age 8. The male-to-female sex ratio was 0.67:1.

Fifty percent of the Arctic cisco had empty stomachs. Stomach contents in descending order of frequency included dipteran larvae, 30%; dipteran adults, 10%; and mysids, 10%.

Arctic Grayling:

Distribution and abundance. Grayling are widely distributed throughout the Colville River drainage. They inhabit both lakes and streams but are seldom found in the brackish waters of estuaries and river deltas.

Adult grayling were captured by gill net throughout the Colville River delta and accounted for 12% of the gill-net harvest. The relative abundance of grayling in the gill-net catch declined from 16% in June to 8% in August. They were absent in catches from the Kupigruak channel and were most abundant in the main stem above the Nechelik channel as well as in the East branch near the confluences of the Miluveach and Kachemach Rivers. Grayling were captured at 24 (49%) of the 49 gill-net sites.

Grayling were captured at 35 (38%) of the 91 seine sites and accounted for 10% of the seine harvest. Twice as many grayling were captured in June as in August. The abundance of rearing grayling increased with distance from Harrison Bay and was greatest along beaches composed of mixed gravel and sand between the Itkillik and Kikiakrorak Rivers.

Growth and maturity. Grayling captured by gill net ranged from 116 to 402 mm and averaged 305 mm in fork length. Weights ranged from 20 to 650 g and averaged 327 g. Fig. 15 shows the length frequency of grayling captured by gill net and seine in the lower Colville River.

Ages of grayling ranged from young-of-the-year through 11 years. Age-specific lengths and maturity of grayling sampled from the Colville River are shown in Table 15. Sexual maturity was first attained at age 5, and 100% of the sample was mature at age 7. Gill-net catches were composed mostly of (77%) mature fish, while seine catches were composed of immature grayling. The male-to-female sex ratio of 119 grayling was 1.70:1.

Table 14. Age-length relationship and maturity of 10 Arctic cisco captured in Colville delta lakes during July 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
6	1	(267)	-	-	0
7	2	296	285-306	14.85	0
8	5	296	270-342	43.81	20
9	2	357	342-371	20.51	50

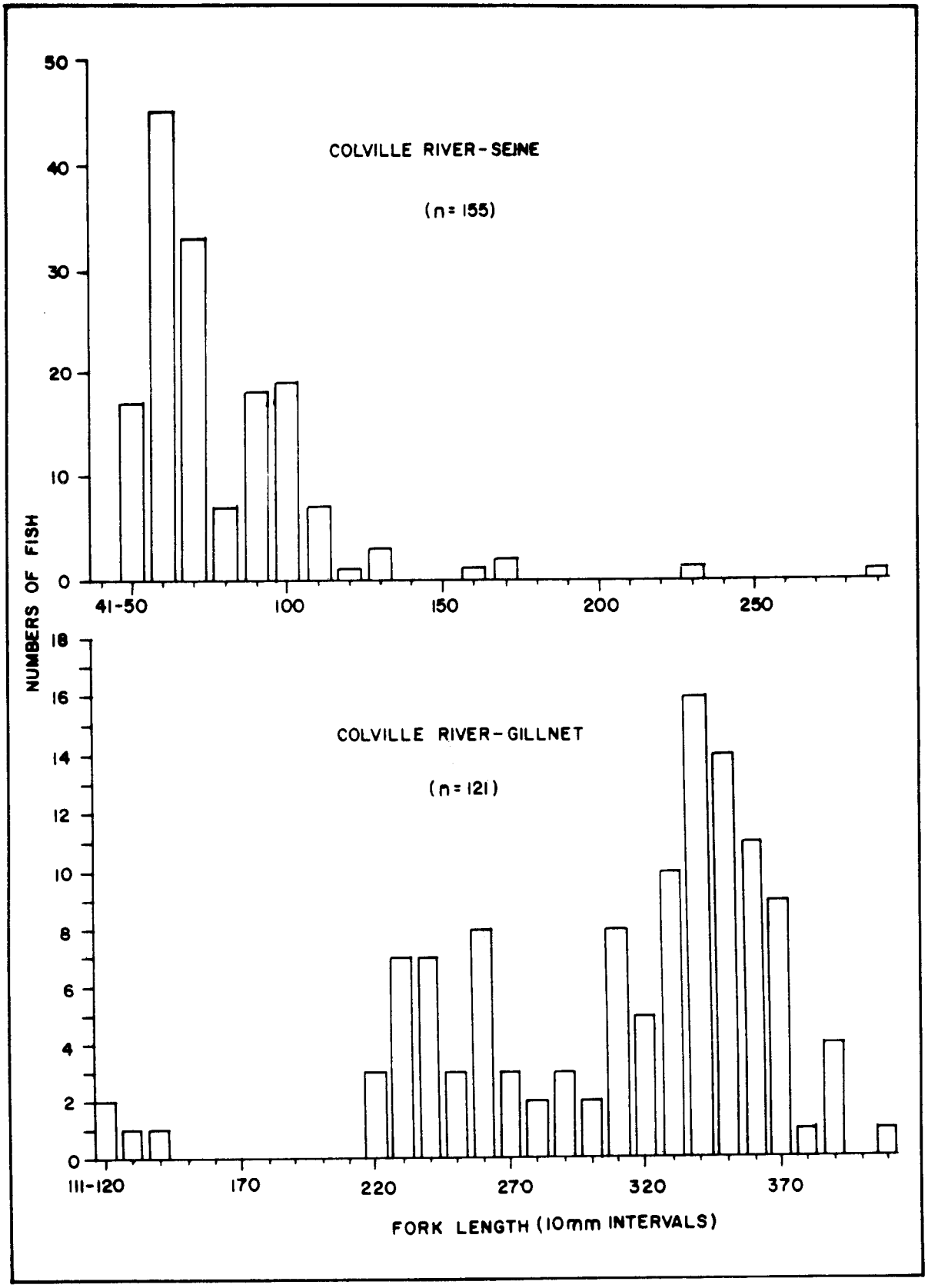

Figure 15. Length-frequency distribution grayling captured by seine and gill net in the lower Colville River, 1985.

Table 15. Age-length relationship and maturity of 142 Arctic grayling captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	1	(49)			0
1	15	76	59-95	13.56	0
2	10	106	87-133	14.32	0
3	3	150	116-211	43.44	0
4	2	222	213-235	11.00	0
5	10	237	218-260	14.22	10
6	36	279	225-343	36.79	67
7	25	331	283-366	23.93	100
8	23	347	315-383	14.34	100
9	12	359	343-385	15.58	100
10	4	364	322-402	28.39	100
11	1	(379)			100

Grayling had completed spawning in the lower Colville River by the beginning of our June sampling period. Recently spawned-out grayling were captured in the Colville River between the Kikiakrorak and Itkillik Rivers and near the confluences of the Miluveach and Kachemach Rivers during June. There was no evidence that grayling used the major channels of the delta for spawning.

Seventy-eight percent of 121 grayling captured by gill net had food in their stomachs. The diet of grayling was composed of a variety of organisms; however, dipteran adults and larvae were the most frequently occurring item.

Grayling were not present in the lakes surveyed during 1985. They were captured in one lake (#6) east of the Colville River delta by McElderry and Craig (1980).

Humpback Whitefish - River:

Distribution and abundance. Humpback whitefish are distributed throughout the lower 168 mi of the Colville River. They inhabit only a few lakes along the Arctic coastal plain and are seasonally abundant in esturaries along the central and western Beaufort Sea coastline. Humpback whitefish were distributed throughout the Kupigruak channel and east branch of the Colville River delta below the confluence of the Kachemach River during the June sampling period. During the August sampling period, humpback whitefish were widely distributed throughout the study area and were captured at 17 (59%) of the 29 gill-net sites. They accounted for 11% of the gill-net catch for the combined sampling periods.

A similar increase in relative abundance and frequency of occurrence of humpback whitefish between the June and August sampling periods was observed in the seine harvest. The total catch and CPUE of humpback whitefish captured by seine was nearly 500% higher in August than in June (Table 4). The frequency of occurrence in seine catches increased from 25% in June to 51% in August. It is likely that humpback whitefish spawned in the middle reaches of the Colville River undergo a downstream migration to rearing areas in the delta during the open-water season.

Growth and maturity. A total of 338 humpback whitefish was captured by seine and gill net in the Colville River delta. Fish captured by gill net ranged from 126 to 462 mm and averaged 311 mm in fork length. Weights ranged from 30 to 1,200 g and averaged 407 g. Fig. 16 shows the length frequency distribution for humpback whitefish captured by gill net and seine in the Colville River.

Ages of humpback whitefish ranged from young-of-the-year to 15 years. Age-6 fish accounted for 37% of the humpback whitefish harvest by gill net. Table 16 shows the age-specific lengths and maturity of humpback whitefish captured in the study area. The male-to-female sex ratio of 119 humpback whitefish was 0.75:1. Thirty-four percent of the fish taken by gill net were prespawners. Humpback whitefish were the oldest maturing species encountered within the study area. Sexual maturity was first reached by age 9. Twenty-eight percent of the fish between age 9

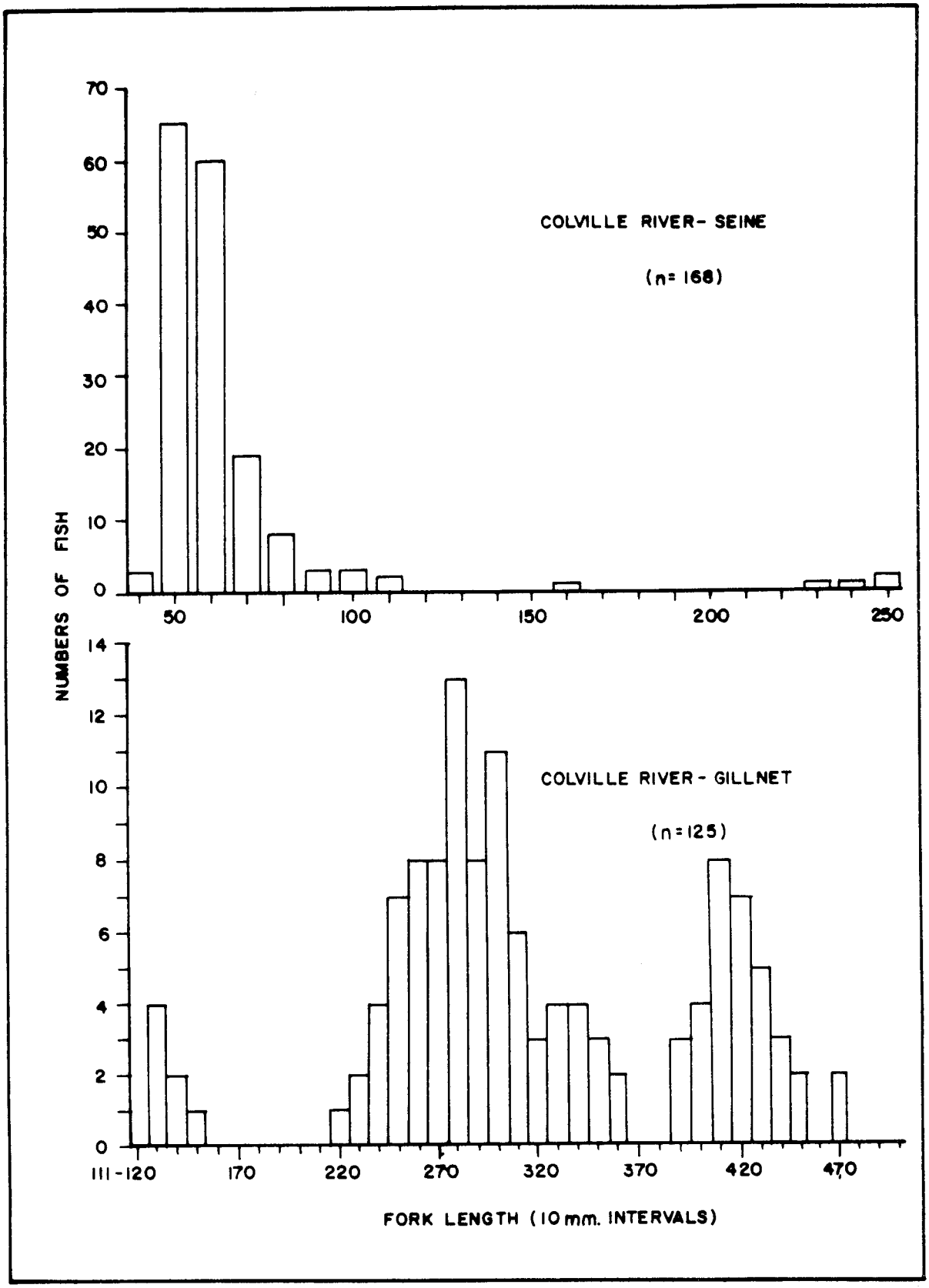

Figure 16. Length-frequency distribution of humpback whitefish captured by seine and gill net in the lower Colville River, 1985.

Table 16. Age-length relationship and maturity of 141 humpback whitefish captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	8	59	50-67	5.90	0
1	10	89	61-102	12.93	0
2	5	131	126-139	4.71	0
3	2	139	129-149	10.00	0
4	1	(230)			0
5	3	240	220-257	15.20	0
6	45	266	223-300	18.13	0
7	16	299	247-346	23.97	0
8	11	324	289-425	35.31	0
9	9	352	290-405	34.30	44
10	7	393	334-430	32.09	72
11	3	401	388-413	10.27	100
12	8	414	391-462	20.89	88
13	8	427	396-450	15.78	100
14	4	434	409-461	19.72	75
15	1	402			100

and 15 were judged to be mature but would not spawn in the year of capture. Ovaries were obtained from a single humpback whitefish on 29 August 1985. The fish measured 430 mm in fork length, weighed 915 g, and was 10 years of age. Egg diameter was 1.9 mm and fecundity was 17,108 eggs.

The majority (64%) of humpback whitefish captured by gill net had empty stomachs (n=125). Dipteran larvae occurred in 30% of the stomachs, while amphipods and vegetation each occurred in 3% of the stomachs.

Humpback Whitefish - Lakes:

Ten humpback whitefish were captured in two (13%) of the lakes surveyed. Humpback whitefish accounted for 3% of the gill-net harvest in the 15 lakes that were sampled. Fork lengths ranged from 228 to 408 mm and averaged 249 mm. Weights ranged from 140 to 850 g and averaged 291 g.

Ages of humpback whitefish ranged from 6 through 13 years. Six-and seven-year-old fish accounted for 80% of the catch. Only two of the fish sampled were mature. The male-to-female sex ratio was 0.9:1; lengths, ages, and maturities of humpback whitefish captured in Colville delta lakes are presented in Table 17.

Fifty percent of the humpback whitefish sampled had empty stomachs. Dipteran larvae occurred in 40% of the remaining stomachs, while fish remains occurred in 10%.

Arctic Char:

Distribution and abundance. Arctic char inhabit several major drainages of the Beaufort Sea from the Colville River to the Canadian Border. Lake-resident populations inhabit waters of the Brooks Range but are rare in low-elevation coastal-plain lakes. Char are abundant in coastal waters during the open-water season but reenter freshwater streams to spawn and overwinter during August and September. The only anadromous stock of char in the Colville River drainage inhabits the Anaktuvuk River. These fish are present in the lower Colville River as migrants throughout the open-water season but are most abundant during June (seaward migration) and late August (in-migration).

Arctic char were distributed throughout the study area during both sampling periods. One hundred thirty-one char were captured by gill net, accounting for 11% of the catch. The proportion of char in the catch was slightly higher in August (12%) than in June (10%), and the CPUE increased slightly in August (0.11 vs. 0.14). Only one char was captured by seine in each sample period, and they represented less than one percent of the seine harvest. Char were the third most frequently occurring species captured by gill net and were captured at 29 (59%) of the gill-net sites. Arctic char are present in the Colville River delta as migrants but do not appear to use the delta as a rearing or feeding area. Ninety-six percent of the char sampled from the delta had empty stomachs (n-111).

Table 17. Age-length relationship and maturity of 10 humpback whitefish captured in Colville delta lakes during July 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
6	5	252	228-276	19.83	0
7	3	260	245-282	19.66	0
13	1	(408)	-	-	100
-	1	(402)	-	-	100

Growth and maturity. Arctic char ranged from 195 to 700 mm and averaged 470 mm in fork length. Weights ranged from 50 to 3,900 g and averaged 1,275 g. The length-frequency distribution of char captured in the Colville delta is shown in Fig. 17.

Ages of Arctic char ranged from 2 to 11 years, with the majority of fish being 8 and 9 years of age. Maturity was first reached by age 5, and 100% of the sample was mature by age 10. Table 18 lists the age-specific lengths and maturity of 110 char captured in the study area. The male-to-female sex ratio of 105 Arctic char was 0.81:1. Sixty-four percent of the char captured by gill net were mature.

Char migrating through the study area continue upstream in the fall to spawn and overwinter in the Anaktuvuk River.

Arctic char were not present in the 15 Colville delta lakes that were surveyed during 1985.

Round Whitefish:

Distribution and abundance. Round whitefish are widely distributed across the North Slope of Alaska. They occur in lakes and streams throughout the Colville River drainage and were moderately abundant within the study area. Round whitefish seldom enter the coastal waters of the Beaufort Sea.

Round whitefish comprised 5% of the total gill-net harvest within the study area (Fig. 4). They were more abundant during the August sampling period (7% of the catch) than in June (3% of the catch). They were captured at 19 (38%) of the 49 gill-net sites and were more widely distributed in August than in June.

Juvenile round whitefish were the second-most-abundant species captured by seine and accounted for 21% of the seine harvest. They were the most widely distributed species captured by seine and were taken at 39 (43%) of the 91 seine sites. The relative abundance and CPUE of round whitefish were higher in August than in June.

Growth and maturity. Round whitefish captured by gill net ranged from 135 to 409 mm and averaged 256 mm in fork length. Weights ranged from 20 to 740 g and averaged 198 g. Fish captured by seine ranged from 46 to 300 mm. Fig 18 shows the length-frequency distribution of round whitefish captured by gill net and seine in the lower Colville River.

Ages of round whitefish ranged from young of the year to 11 years. Sexual maturity first occurred at age 8, and 100% of the sample was mature at age 9. Eighty-seven percent of the round whitefish taken by gill net were immature, and all of the those captured by seine were immature. Table 19 shows the age-specific lengths and maturity of round whitefish captured in the Colville River delta. The male-to-female sex ratio of 51 round whitefish was 0.7:1.

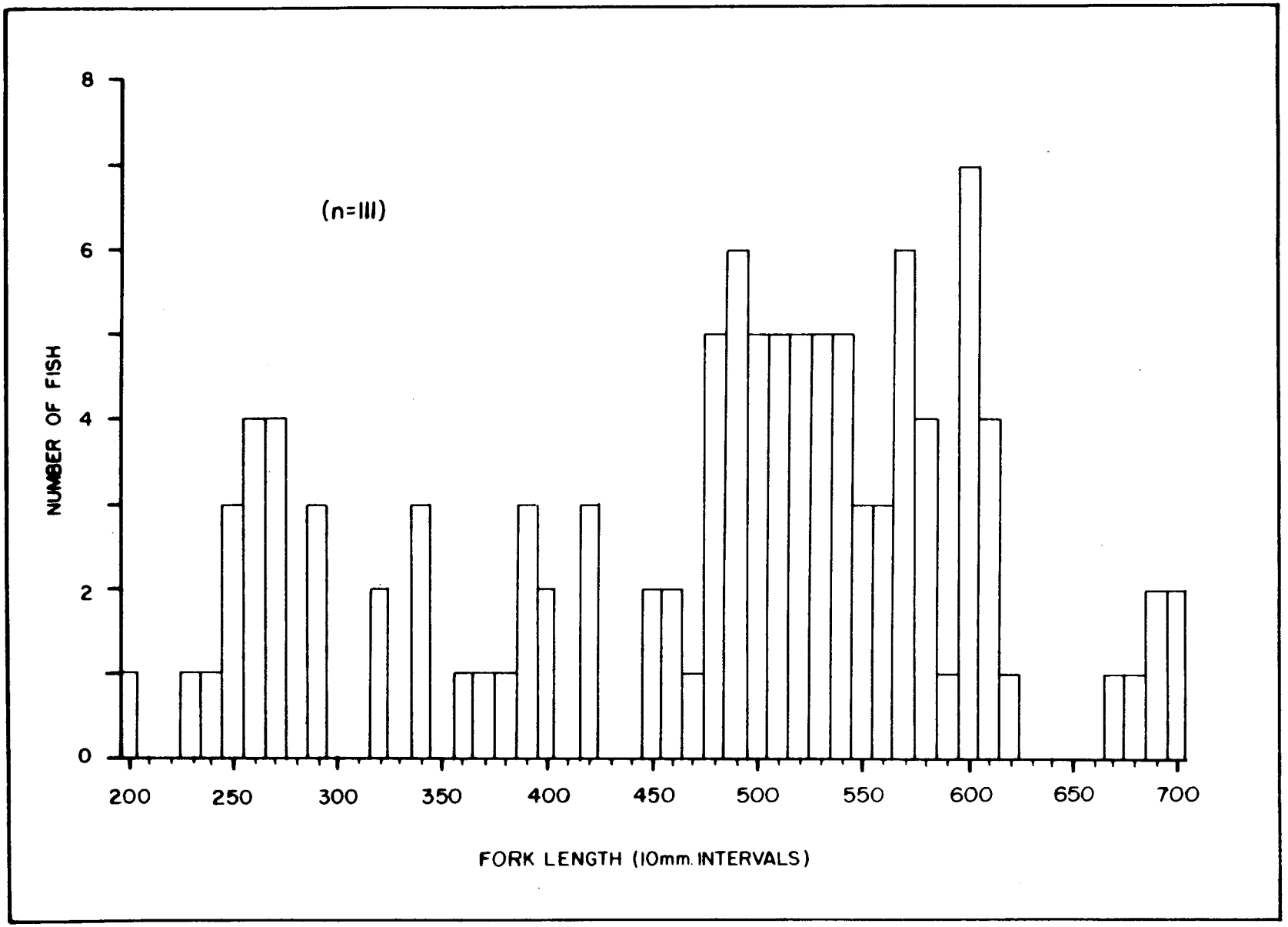

Figure 17. Length-frequency distribution of Arctic char captured by gill net in the lower Colville River, 1985.

Table 18. Age-length relationship and maturity of 110 Arctic char captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
2	1	(221)			0
3	4	281	195-386	69.51	0
4	4	263	238-313	29.52	0
5	10	315	245-445	59.88	10
6	12	323	243-560	87.22	17
7	13	448	366-502	43.47	69
8	22	512	412-598	41.59	73
9	32	568	467-700	63.54	97
10	11	584	515-689	47.05	100
11	1	(609)			100

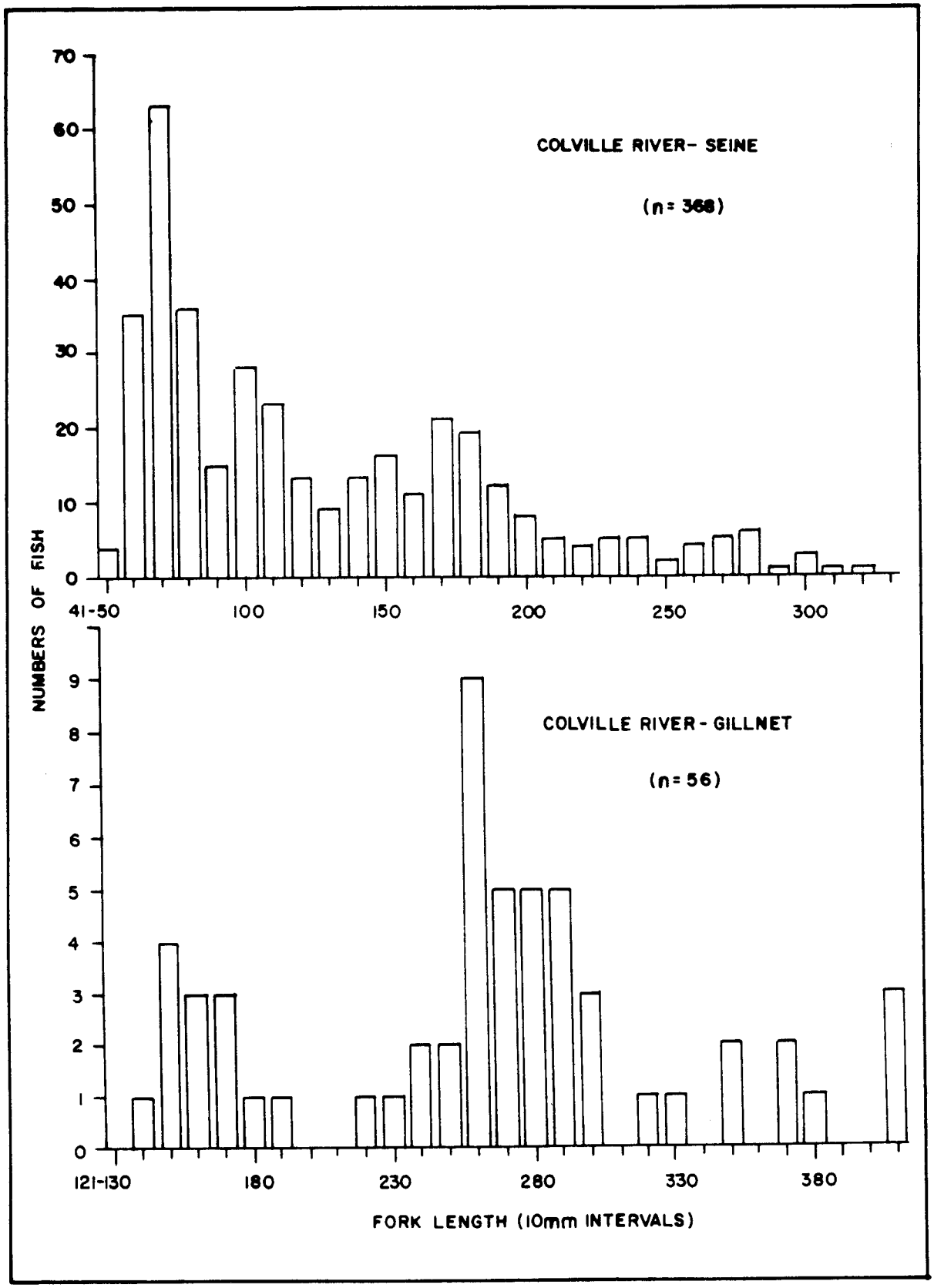

Figure 18. Length-frequency distributions of round whitefish captured by seine and gill net in the lower Colville River, 1985.

Table 19. Age-length relationship and maturity of 88 round whitefish captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	5	63	49-71	7.71	0
1	13	86	62-105	13.32	0
2	7	133	115-148	13.08	0
3	17	157	140-188	12.67	0
4	8	184	163-233	23.79	0
5	8	257	230-279	17.26	0
6	17	271	248-314	18.02	0
7	4	288	284-292	3.20	0
8	5	336	300-365	22.42	40
9	1	(368)			100
10	2	391	380-401	10.50	100
11	1	(409)			100

Round whitefish are reported to spawn in the major tributaries and main stem of the Colville River (Bendock 1979); however, they are not reported to spawn in the delta. Ovaries were obtained from three round whitefish on 29 August 1985. These fish averaged 363 mm in fork length, 525 g in weight, and ranged from 8 to 10 years in age. Egg diameter averaged 2.4 mm and fecundity averaged 6,646 eggs.

Seventy-two percent of the round whitefish captured by gill net in the Colville delta had empty stomachs. The remaining 28% were feeding on dipteran larvae. Only one round whitefish was captured in a Colville delta lake (#43); it was an immature 3-year old with an empty stomach, measuring 137 mm in fork length.

Rainbow Smelt:

Distribution and abundance. Rainbow smelt are locally abundant near major river deltas in the Chukchi and Beaufort Seas. They are not known to occur in inland lakes or streams on the North Slope and occur in relatively low abundance in nearshore coastal waters of the Beaufort Sea.

Rainbow smelt were captured only by gill net and seine during our June sampling period. They were distributed from the outer delta upstream to Ocean Point. They accounted for 7% of the June gill-net harvest (Fig. 4) and were captured at 4 (20%) of the 20 gill-net sites. Rainbow smelt accounted for 1% of the June seine harvest and were captured at 4 (8%) of the 48 seine sites.

Growth and maturity. Rainbow smelt ranged from 198 to 305 mm in fork length and averaged 219 mm. Weights ranged from 50 to 150 g and averaged 81 g. The length-frequency distribution of 39 rainbows smelt captured in the Colville delta is shown in Fig. 19. Ages ranged from 5 to 10 years. Age-7 fish accounted for 77% of the harvest. Table 20 shows the age-specific length and maturity of rainbow smelt captured in the study area. The male-to-female sex ratio of 39 rainbow smelt was 1.3:1.

All of the smelt captured in June were sexually mature, had recently spawned, or were still in the process of spawning. No subadult smelt were captured in either June or August, suggesting that rearing takes place in coastal waters rather than in the Colville River delta. Overwintering smelt were reported to enter the delta during October and November (L. Moulton, pers. comm.). Rainbow smelt in the Colville River appear to be later maturing and slower growing than reported by Morrow (1980).

Rainbow smelt overwinter in the Colville River delta and Harrison Bay. They accounted for 13% and 57% of the winter catch in the Colville delta and coastal areas of the Beaufort Sea, respectively (Craig and Haldorson 1980).

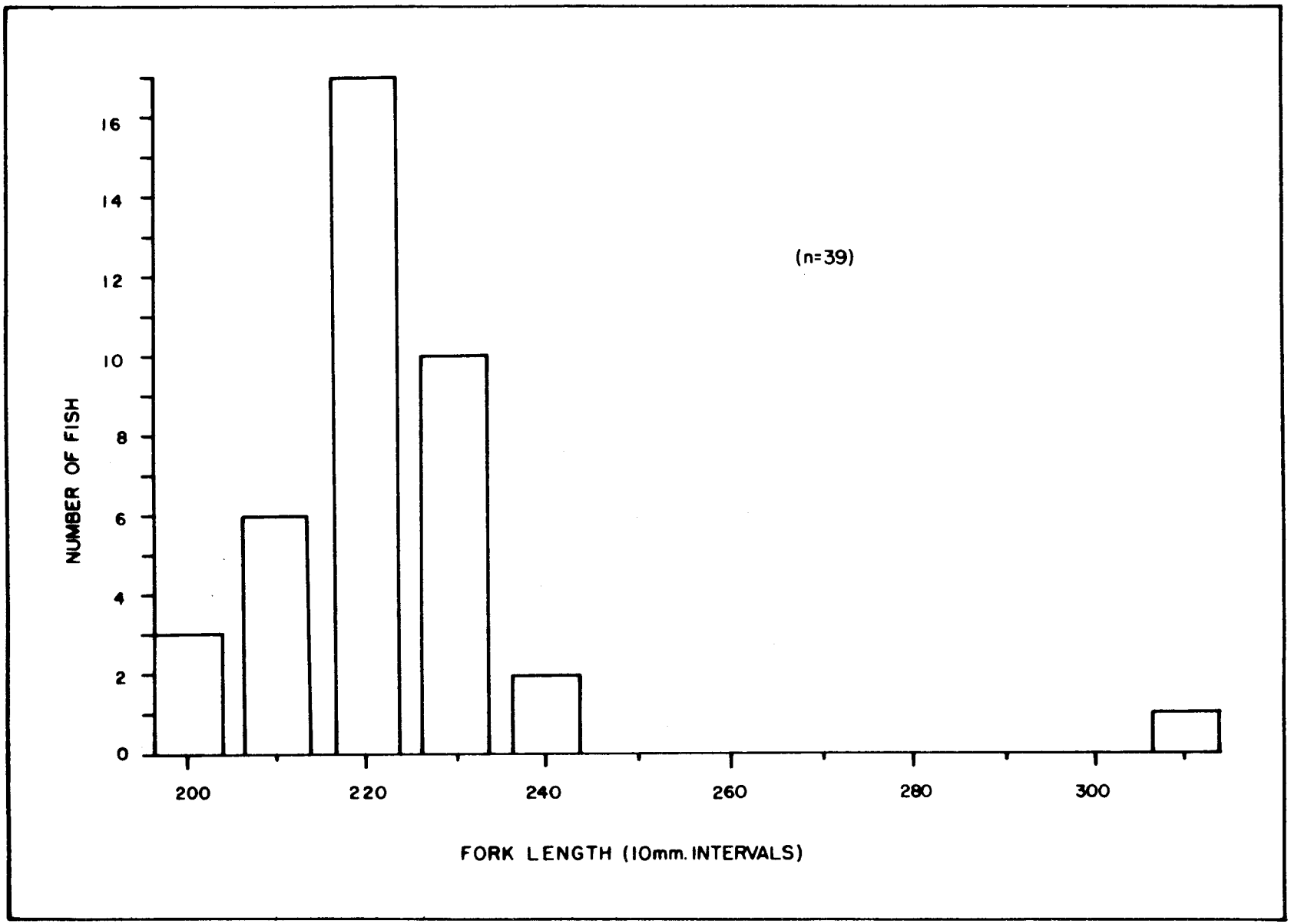

Figure 19. Length-frequency distribution of rainbow smelt captured by gill net in the lower Colville River, 1985.

Table 20. Age-length relationship and maturity of 39 rainbow smelt captured in the Colville River delta during June and August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
5	2	198	198-198	0	100
6	5	204	200-207	2.61	100
7	30	220	205-232	6.85	100
8	1	(223)			100
9	0				
10	1	(305)			100

All of the rainbow smelt captured in the Colville River delta during June had empty stomachs. Rainbow smelt were not captured in the 15 Colville delta lakes that were sampled.

Other Species:

Burbot. Burbot are widely distributed throughout lakes and streams in the Colville River drainage. They are rarely found in coastal waters but are found in the Colville River delta throughout the year (Kogl and Schell 1975).

Sampling was conducted for burbot using gill nets, seines, hoop nets, and set lines. Two burbot were captured by hoop net, three by seine, and 11 by gill net. While widespread throughout the study area, their abundance appeared to be low.

Burbot ranged from 55 to 680 mm in total length and averaged 406 mm (n=16). Weights ranged from 20 to 2,050 g and averaged 647 g. Ages ranged from young of the year to 10 years. Three (19%) of the burbot were mature. The male-to-female sex ratio was 1:1. The following frequency of food items were found in burbot stomachs: fish, 50%; dipteran larvae, 13%; and fish eggs, 6%. Thirty-one percent of the burbot had empty stomachs. Burbot were not captured by gill net in the 15 Colville delta lakes that were sampled.

Longnose suckers. Longnose suckers were distributed throughout the study area. They accounted for 6% of the gill-net catch and and 29% of the seine catch. Their distribution within the study area decreased between June and August. During the June sampling period, longnose suckers were captured at 14 (70%) of the 20 gill-net sites and were the most frequently occurring species encountered (Fig. 5). During August they were encountered only at 8 (28%) of the 29 sites. Juvenile longnose suckers were captured by seine throughout the study area upstream from the Kupigruak channel; however, they were absent from August seine catches.

Longnose suckers ranged from 120 to 504 mm in fork length and averaged 366 mm. Recently spawned longnose suckers were captured during June in the Kupigruak channel, East Branch, and main stem Colville River downstream from the confluence with the Kikiakrorak River. Longnose suckers are reported to overwinter in middle reaches of the Colville River (Bendock 1980) but have not been reported during overwintering investigations in the delta. The length-frequency distribution of 63 longnose suckers captured by gill net in the Colville River delta is shown in Fig. 20.

Longnose suckers were captured in one (#41) of the 15 lakes that were surveyed, representing 3% of the gill-net harvest in lakes.

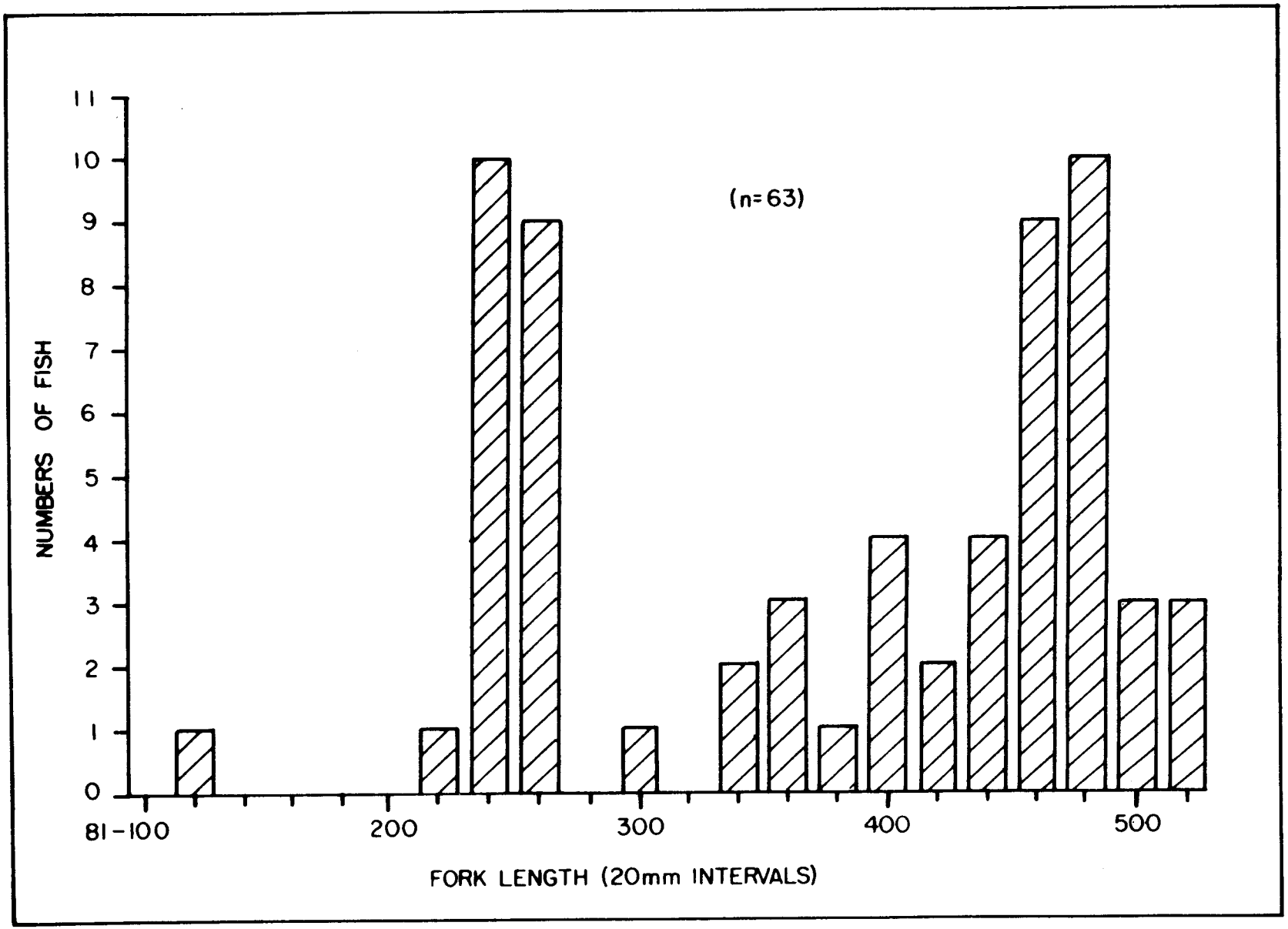

Figure 20. Length-frequency distribution of longnose sucker captured by gill net in the lower Colville River, 1985.

Pink salmon. Pink salmon occur sporadically and in low abundance in North Slope streams. They are reported to spawn in the main stem of the Colville River as well as in several major tributary streams, including the Itkillik, Anaktuvuk, and Chandler Rivers (Bendock 1979).

Pink salmon were not encountered during the June sampling period. Six pink salmon were captured by gill net during the August sampling period. Mid-eye to tail-fork lengths ranged from 418 to 492 mm and averaged 453 mm. Weights ranged from 1,000 to 1,600 g and averaged 1,250 g. All of the pink salmon captured were mature males.

Arctic Lamprey. Arctic lamprey were found as food items in burbot captured between the Kikiakrorak River and Ocean Point. A gravid female lamprey (178 mm total length) was found in a burbot during the June sampling period, while three lampreys were found in a single burbot during the August sampling period. Total lengths ranged from 145 mm to 205 mm and averaged 183 mm.

Fourhorn sculpin. Fourhorn sculpin are abundant in the marine and coastal waters of the Beaufort Sea, and they are reported to overwinter throughout the Colville delta (Kogl and Schell 1975; Craig and Haldorson 1980).

Fourhorn sculpin were captured throughout the study area from the confluence of the Itkillik River downstream to Harrison Bay during both sampling periods. They accounted for less than 1% of the total gill-net catch and 1% of the seine catch. Fourhorn sculpin were more widely distributed in August than in June. Total lengths ranged from 133 to 274 mm and averaged 205 mm.

Slimy sculpin. Slimy sculpin are widely distributed and abundant in lakes and streams within the Colville River drainage. They were absent from gill-net catches within the study area but accounted for 5% of the total seine harvest. The distribution of slimy sculpin was associated with the presence of gravel along beaches and river bars. They were not found in the lower delta but increased in abundance with distance upstream from the Nechelik channel.

Lake trout. Two lake trout were captured in the Colville River near the confluence of the Kikiakrorak River during the August sampling period. They averaged 483 mm in fork length and 1,363 g in weight and were 12 years old. Both fish were mature females in non-spawning condition. Lake trout are only incidental inhabitants of the lower Colville River and do not appear to use the region for spawning, rearing, or overwintering. They occur in low numbers throughout the year in the middle reaches of the Colville River (Bendock 1979, 1981).

Ninespine stickleback. Ninespine stickleback are common throughout the middle and upper reaches of the Colville River drainage and in lakes and streams along the Arctic coastal plain. They were absent from Colville River delta catches; however, a single ninespine stickleback was found in the stomach of a humpback whitefish captured in lake #30.

Alaska blackfish. On the North Slope, Alaska blackfish are limited in distribution to the lowlands of the Arctic coastal plain. They were not captured in the lower Colville River; however, a single blackfish was found in the stomach of a least cisco captured in lake #31.

Arctic flounder. Arctic flounder are common throughout coastal waters of the Beaufort Sea. They are reported to occur in the lower Colville River (McElderry and Craig 1980); however, none were captured in this study. A single Arctic flounder was captured in lake #43.

Amiloyak Lake Survey

Amiloyak Lake (Fig. 21) is the uppermost lake in the Chandler River drainage, located at lat 68°06'30"N, long 152°52'30"W. Situated in a glacial valley near the continental divide of the Brooks Range, Amiloyak Lake lies 28 mi west of Anaktuvuk Pass. It has an estimated surface area of 320 acres, a maximal measured depth of 25 ft, and a surface elevation of 3,130 ft; it is 1.7 mi long. A survey of Amiloyak Lake was conducted during 31 July to 2 August 1985. Sampling for fish was conducted by gill net, hoop net, minnow trap, and baited set line. The distribution of sampling effort is shown in Fig. 21. Five species of fish including Arctic char, lake trout, grayling, round whitefish, and slimy sculpin were captured. Amiloyak Lake has a substrate varying from sand to large cobble and rubble. Aquatic vegetation is sparse. Water temperature in the lake during our survey was 55°F; total hardness ($CaCo_3$), 17.1 ppm; and the pH 7.5. The water is colorless, with a Secchi depth of 12 ft.

Three inlets enter the lake from the south and east. In addition, a small number of springs may be present. There is single outlet that flows north to Chandler Lake. The principal inlet enters from the southwest and originates in a spring approximately three-quarters of a mile south of the lake. It has a substrate of cobble and angular rubble near the source, grading to sand near the lake. Moderate amounts of filamentous algae cover the substrate in the upper half of the inlet. The upper third of the inlet is braided, while the lower reaches form a single channel that is vegetated above the waterline. On 1 August the estimated flow was 9.6 cfs. Water temperature was 45° F, pH 7.5, and total hardness ($CaCo_3$) 17 ppm.

The two remaining inlets enter the east shore of Amiloyak Lake. The inlet on the northeast corner of the lake had an estimated flow of 3.3 cfs. Water temperature was 38° F, total hardness ($CaCo_3$) 34 ppm, and pH 7.5. It has a substrate of unvegetated gravel. The inlet entering on the southeast corner of the lake had an estimated flow of 1.4 cfs. Water temperature was 41° F, total hardness ($CaCo_3$) 34 ppm, and pH 7.0. The substrate was unvegetated cobble.

The single outlet located at the north end of the lake is generally shallow (less than 1 ft deep) and approximately 25 ft wide. Estimated flow on July 31 was 20.8 cfs, and the water temperature was 55° F.

Graduated-mesh gill nets were set in a variety of habitats for a total of 92.1 net hrs. The total gill net catch was 169 fish, yielding a CPUE

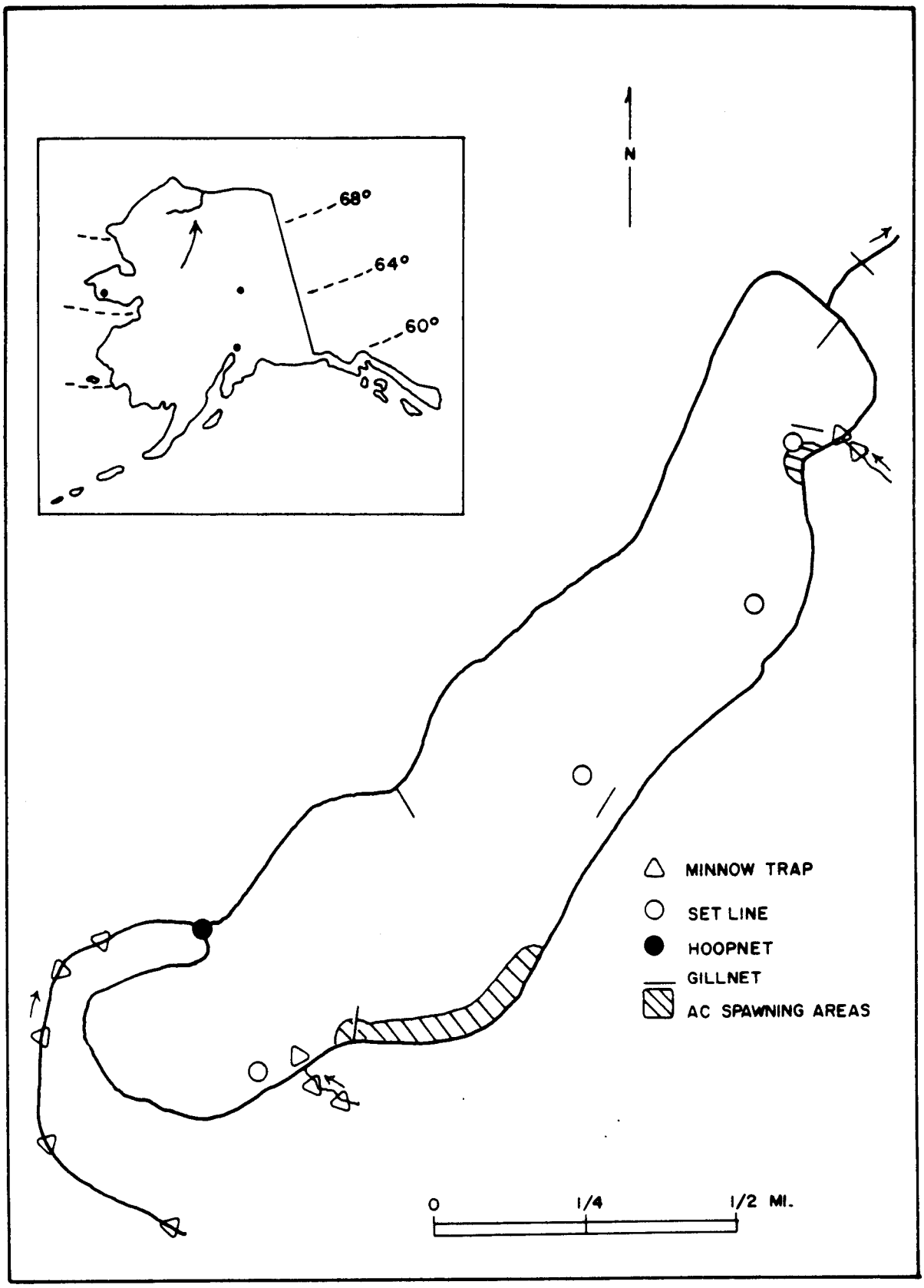

Figure 21. Map of Amiloyak Lake showing the location of sampling effort, 1985.

of 1.83 fish/net hour. The gill-net catch was composed of 52 Arctic char (31%), 46 grayling (27%), 38 round whitefish (22%), and 33 lake trout (20%).

Baited setlines were fished for a total of 59.1 hours. No fish were captured by this method.

Minnow traps baited with salmon eggs were fished in the three inlet streams for a total of 47.5 hours. Ten slimy sculpin were captured in the traps set near the confluences of the inlets. CPUE for all of the traps fished was 0.21 fish/trap hour.

A hoop net was set in the mouth of the southwest inlet. The hoop net was fished for a total of 39.5 hours; 166 fish were captured, yielding a CPUE of 4.2 fish/net hour. The hoop-net catch was composed of 141 Arctic char (85%), 23 grayling (14%), and 2 lake trout (1%).

The southwest inlet and lake shore adjacent to the inlet was seined with a 100-x 4-ft beach seine. In addition, approximately 4 man-hours of angling for Arctic char was conducted off the inlet mouth. The seining and angling efforts yielded an additional 105 Arctic char.

Arctic char:

A total of 298 Arctic char was captured in Amiloyak Lake. Two hundred twenty-nine of these fish were measured for fork length, tagged with numbered yellow Floy tags, and released. The remaining 63 char were sampled. Arctic char fork lengths ranged from 57 to 619 mm and averaged 518 mm (n=298). A length-frequency distribution for Arctic char is shown in Fig. 22. Weights ranged from 2 to 2,400 g and averaged 1,667 g (n=63).

Ages of char ranged from young of the year to 19 years. Age, length, and maturity data are summarized in Table 21. The age at first maturity for char was 9 years; at that age 100% of the fish sampled were mature. The frequency of spawning was not determined. Seventy-six percent of the char sampled were mature and in prespawning condition. The male-to-female sex ratio was 1.3:1. Estimates of fecundity were obtained from a sample of 12 female char (Table 22). Average fecundity was 3,169 eggs for females ranging from 465 to 520 mm in fork length and the average egg diameter on 1 August was 4.9 mm.

The majority (86%) of the char that were sampled (n=63) had empty stomachs. Stomach contents in descending order of frequency included snails, 7.9%; zooplankton, 4.8%; and clams,1.6%.

Grayling:

Seventy-three grayling were sampled from Amiloyak Lake. Fork lengths ranged from 218 to 400 mm and averaged 327 mm. Weights ranged from 200 to 600 g and averaged 353 g. The length-frequency distribution for grayling is shown in Fig. 22.

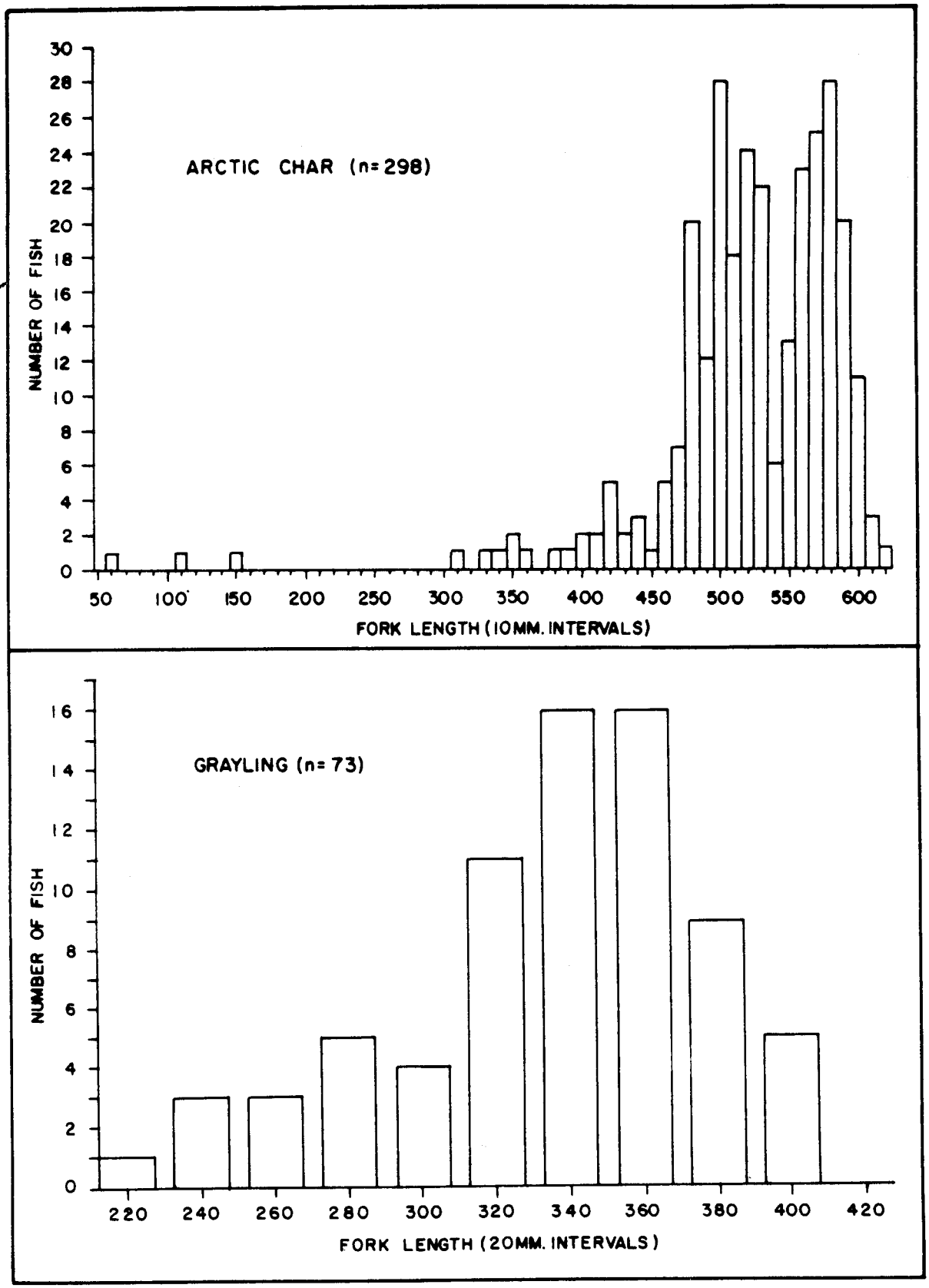

Figure 22. Length-frequency distributions of Arctic char and grayling captured by gill net in Amiloyak Lake, 1985.

Table 21. Age-length relationship and maturity of 63 Arctic char captured in Amiloyak Lake during July 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
0	1	(57)			0
1	2	127	110-145	24.75	0
6	2	323	305-341	25.46	0
7	1	(348)			0
8	1	(425)			0
9	1	465			100
10	8	493	472-517	19.59	100
11	8	496	435-518	26.41	75
12	9	514	490-546	22.71	89
13	7	554	520-580	23.97	71
14	7	566	551-594	14.43	100
15	7	569	540-591	16.83	100
16	5	580	574-585	4.21	100
17	2	590	588-592	2.83	100
18	1	(601)			100
19	1	(575)			100

Table 22. Fecundity of 12 Arctic char captured in Amiloyak Lake, during August 1985.

Fork Length (mm)	Egg Diameter (mm)	Total # of Eggs
490	5.0	3,638
482	4.7	3,039
513	5.5	2,012
465	4.9	3,232
497	5.3	2,614
520	4.9	3,145
500	4.7	3,135
517	5.0	3,279
517	4.7	2,681
490	4.8	3,790
490	4.8	3,776
500	5.4	3,689
$\bar{x}$ = 498	4.98	3,169
$\bar{s}D$ = 16.45	0.28	536.31

Ages of grayling ranged from 4 through 11 years (n=69). Age, length, and maturity data for grayling are summarized in Table 23. Grayling first matured at age 5, and 88% of age-7 fish were mature. The male-to-female sex ratio was 0.65:1. Dipteran larvae and adults were the most frequently occurring items found in grayling stomachs.

Round whitefish:

A total of 38 round whitefish was captured and sampled from Amiloyak Lake. Fork lengths ranged from 252 to 441 mm and averaged 350 mm. Weights ranged from 250 to 1,000 g and averaged 539 g. The length-frequency distribution for round whitefish is shown in Fig. 23.

Ages of round whitefish ranged from 6 through 18 years. Age at first maturity was 8 years, and by age 9, 100% of the round whitefish sampled were mature. The male-to-female sex ratio was 1.06:1. Age, length, and maturity data for round whitefish are summarized in Table 24.

Eight percent of the round whitefish sampled had empty stomachs. Stomach contents in descending frequency of occurrence included clams, 31%; dipteran adults, 23%; caddis larvae, 15%; dipteran larvae, 15%, and snails, 8%.

Lake trout:

A total of 30 lake trout was captured and sampled from Amiloyak Lake. Fork lengths ranged from 388 to 933 mm and averaged 480 mm. Weights ranged from 550 to 11,000 g and averaged 1,452 g. The length-frequency distribution of lake trout is shown in Fig. 23.

Ages ranged from 9 through 40 years. The age at first maturity was 12 years. Frequency of spawning was not determined. The male-to-female sex ratio was 0.6:1. Age, length, and maturity data for lake trout are summarized in Table 25. Forty-five percent of the lake trout that were sampled had empty stomachs. Stomach contents in descending frequency of occurrence included voles, 21%; fish, 21%; clams, 7%; and snails, 7%.

Experimental Arctic Char Egg Take

Approximately sixty lakes and ponds in interior Alaska are annually stocked with hatchery-incubated and reared fish, resulting in more than 60,000 man-days of recreational fishing. Rainbow trout, *Salmo gairdneri*; coho salmon, *Oncorhynchu kisutch*, and grayling are currently used to meet the annual stocking needs. Sheefish, *Stenodus leucichthys*, and chinook salmon, *Oncorhynchus tshawytscha*, are two species that are being experimentally evaluated for use in the lake-stocking program.

In an effort to increase the diversity of species available to the Interior angler, the suitability of Arctic char for introduction as a recreational species will be evaluated by ADF&G personnel. Char are indigenous to the Yukon River drainage, the Tanana River drainage, but

Table 23. Age-length relationship and maturity of 69 grayling captured in Amiloyak Lake during August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
4	1	(218)			0
5	7	257	235-283	18.67	14
6	6	267	238-290	21.64	50
7	12	313	297-329	11.02	88
8	29	340	304-370	18.99	100
9	8	361			
10	4	385	375.400	11.18	100
11	2	400	400	0	100

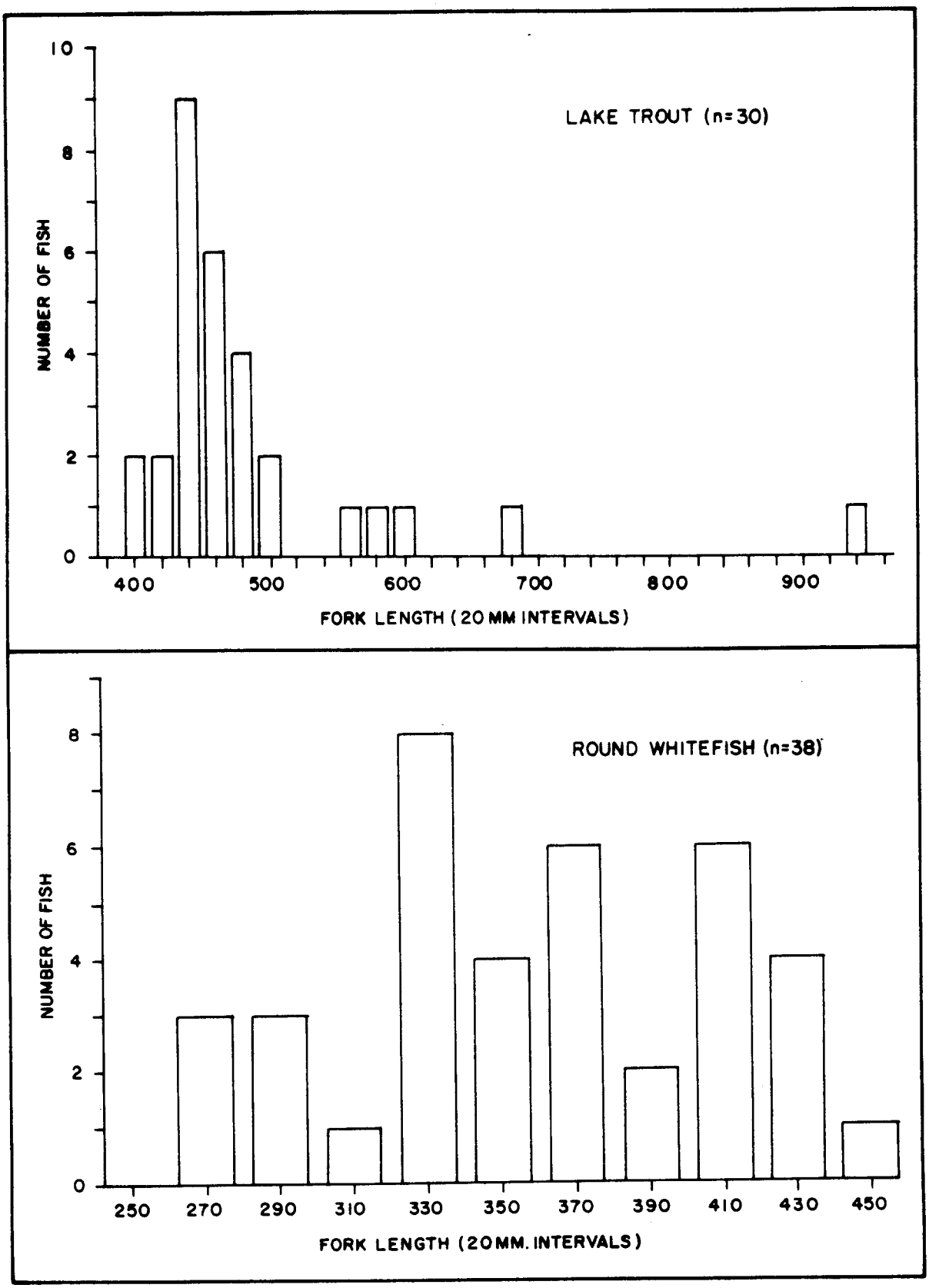

Figure 23. Length frequency distributions of lake trout and round whitefish captured by gill net in Amiloyak Lake, 1985.

Table 24. Age-length relationship and maturity of 37 round whitefish captured in Amiloyak Lake during August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
6	1	252			0
7	4	271	258-285	12.09	0
8	7	314	280-350	22.35	71
9	7	331	318-343	9.56	100
10	5	364	358-383	10.55	100
11	2	377	370-384	9.90	100
12	1	391			100
13	1	391			100
14	4	403	392-412	8.30	100
15	3	418	410-430	10.58	100
17	1	415			100
18	1	441			100

Table 25. Age-length relationship and maturity of 30 lake trout captured in Amiloyak Lake during August 1985.

Age Class	No.	Fork Length (mm)			% Mature
		Mean	Range	SD	
9	1	(398)			0
11	2	427	421-432	7.78	0
12	8	425	388-448	20.06	29
13	4	451	435-477	18.77	66
14	3	525	438-678	133.17	50
15	1	(438)			0
16	2	(456)			100
17	2	526	480-571	64.35	100
20	1	(587)			100
23	1	(466)			100
24	1	(542)			100
25	1	(473)			100
30	1	(486)			100
32	1	457			100
40	1	(933)			100

they do not occur in large numbers near the road system. The advantages of introducing char into landlocked lakes include their desirability both as a sport fish and food fish, greater longevity than species currently stocked, potential for large size, and plasticity in feeding habits.

Amiloyak Lake (Fig. 21) was selected as an Arctic char egg-take site. Prespawning Arctic char congregate off the southwest inlet to Amiloyak beginning in mid-July and are easily captured by seine, hoop net and angling. Char leave the inlet in early September to spawn along the shoreline of the lake. Two spawning locations were identified on 2 September along the eastern perimeter of the lake (Fig. 21). Ripe female char were captured over steep rubble bottoms in water that was 4 to 15 ft deep and 46° F.

During late July, samples of spleen, kidney, gill and gonads were obtained from 60 Amiloyak Lake char and sent to the Fish Pathology Section of the Dept. of Fish and Game. Samples were analyzed for virology and parasite load. No viral or parasitic pathogens were detected in the sample and the Amiloyak Lake char stock was approved for incubation and rearing in the state hatchery system.

Char were captured in graduated mesh, monofilament, sinking gill nets set along the eastern shoreline of Amiloyak Lake during the first two days of September 1985. Gill nets were checked at 2 hour intervals. Live char were segregated by sex and placed in two holding pens located off the inlet on the southwest corner of the lake. A total of 31 females and 19 males were held in the pens. Approximately 27,000 eggs were live-stripped from the char and fertilized on 3 September. All of the male fish were in spawning condition; however, approximately 20 of the 31 females were not ready to release eggs at the time of our departure. The fertilized eggs were flown to the Clear Hatchery for incubation and rearing.

The char eggs were placed in incubation trays and maintained at an average temperature of 39° F. They were shocked and sorted on 31 October, at which time approximately half (13,000) of the eggs were viable. The poor survival of eggs was due primarily to our attempt to obtain eggs from females that were not yet ready to spawn. Hatching began on 2 January 1986 (803°F temp. units) and was completed on 7 January 1986 (837° F temp. units). The sac-fry were maintained in the incubation trays at a temperature of 39° F until the present time (1 March, 1985).

It is anticipated that the Arctic char fingerlings resulting from this eggtake will be stocked in a landlocked, barren lake located approximately 80 mi west of Fairbanks in the Kantishna River drainage.

Arctic Char Aerial Counts

Arctic char stocks inhabiting the Sagavanirktok River drainage spawn, rear and migrate in close proximity to the northern 200 miles of the Alyeska Pipeline and Dalton Highway. These same stocks of char migrate

to the Beaufort Sea (seasonally) where they feed extensively in estuarine waters before returning to freshwater to spawn and overwinter. Industrial activities such as road, causeway, and gravel island construction, gravel mining, and water withdrawal have the potential for altering the feeding and migration behavior of char as well as diminishing the quality of habitats critical to the survival of these stocks.

In order to monitor the status of Sagavanirktok River char stocks, aerial counts have been attempted annually in this drainage since 1971. Aerial-survey areas were reduced to a single index area in the Ivishak River in 1976. In 1979 an index area on the Anaktuvuk River was established. Anaktuvuk River char stocks have been relatively undisturbed by past industrial activity; however, new developments in the Colville River delta and Kuparuk oil field have increased concerns for these stocks.

Aerial counts are not statistically based estimates of populations; rather, they are a means of annually indexing the fall distribution and relative abundance of char. Counts are conducted during the third week of September, using a Piper PA-18 aircraft. Adverse weather conditions in September of 1985 precluded counting char in both the Ivishak and Anaktuvuk Rivers.

Snow, gale-force winds, and below-normal temperatures contributed to an early freeze-up across much of the North Slope. Shelf ice covered a substantial portion of both the Anaktuvuk and Ivishak Rivers by 20 September, and slush ice obscured visibility through the water. Table 26 lists the values for previous counts in the Anaktuvuk and Ivishak Rivers.

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Table 26. Aerial estimates of Arctic char on the North Slope from 1971 to 1985.

Year	Location		Date
	Ivishak River	Anaktuvuk River	
1971	24,470		
1972	11,937		
1973	8,992		
1974	11,000		
1975	8,306		9/20
1976	8,570		9/22
1977	---		
1978	---		
1979	24,403	15,717	9/22
1980	---	---	---
1981	24,873	10,536	9/14
1982	36,432	6,222	9/19
1983	27,820	8,743	9/18
1984	24,818	5,462	9/18
1985	---	---	---

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